Cross Country Ski Trails

Alberta
RECREATION AND PARKS
Recreation Development Division

DDN 8400634

CANADIANA
OCT 12 1988

CROSS COUNTRY SKI TRAILS

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In plain English, this document provides you with a variety of recreation facility ideas. None of the drawings are intended for construction purposes. The designs come from various sources and do not represent Alberta government standards.

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July, 1988

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INTRODUCTION

Over the last ten years, cross-country skiing has increased in popularity. In the 1984 public opinion survey on recreation activities by Albertans, cross-country skiing ranked tenth. Along with this increasing popularity is an increased need for quality trails on which to ski, from the basic to the competitive trail system.

Whether you are planning a basic or competitive trail system, the information in this manual will give you a starting point for your trail development project.

This manual will provide you with a general overview for the planning, design, construction, maintenance, and programming of a cross-country ski trail system. The regulatory agencies you may have to deal with are listed at the end of the manual.

In general, this manual will give you the framework for organizing and developing your trail system. It will not provide in-depth explanations about various technical details related to that framework (e.g., in the design section of this manual, use of aerial photographs to lay out your trail system will be recommended; however, photo interpretation techniques will not be given). This manual is intended to give you some general ideas on guidelines to cross-country ski trail development and does not in any way profess to give standards for trail development.

Racing and competition are not extensively dealt with in the manual. However, you can obtain additional technical information by contacting Cross Country Alberta (see the sources section at the end of the manual).

Each of the topics dealt with in the manual—planning, design, construction, maintenance, and programming — will have its own distinct section. Though each of these areas are interrelated, each can be used by itself.

We hope this manual will be of use to you in getting your trail project off to a good start and will ensure success in avoiding potential problem areas. Good luck with the development of your trail system.

PLANNING

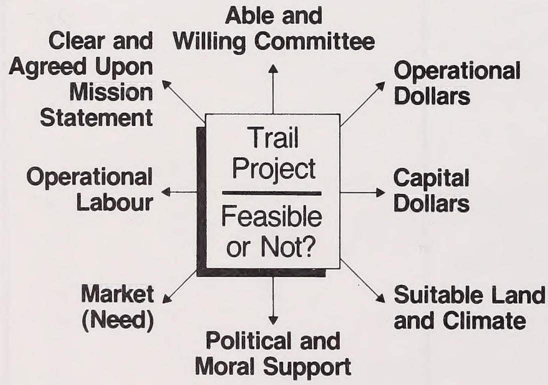
Introduction

The word "planning" can scare people, because it suggests a great deal of time, effort, and complexity. With most projects, this is true. However, there are many advantages to planning that outweigh the time and effort spent in this area of your trail project. Some of these advantages are:

- development of a trail system that is suited to the people using it at the proper skill level;
- development of trails that you are financially able to construct and operate;
- identification of problem areas before the trail is constructed and finding ways to solve these problems (for example, gaining access to private land); and
- makes best use of finances and labour in the long term.

Basically, then, the planning process is a method of taking an idea, that of building cross-country ski trails, and determining whether it is feasible or not and, if so, how to get it done.

Whether or not it is feasible is dependant on a number of factors. Once you have investigated these factors, you will have a good idea of the feasibility of the project. All of the information you have collected then will form the basis of a master plan for your trail project. The master plan is used in the design and construction of your cross-country ski trail system.


Able and Willing Committee
Clear and Agreed Upon Mission Statement
Operational Dollars
Trail Project
Feasible or Not?
Operational Labour
Capital Dollars
Market (Need)
Suitable Land and Climate
Political and Moral Support

Is Your Project Feasible?

Committee Formation

The committee is one of the key factors to ensure that a ski trail development project is carried through from start to finish. When picking a team of people for your project, the following skills should be considered:

- Leadership — chairperson, public relations
- Writing — secretarial, grant submissions
- Financial — fundraising, grant knowledge, budgeting
- Cross-country skier — knowledge of sport for trail design and programming
- Municipal representative — political support, mapping, planning expertise
- Construction — municipal engineer

People suited to these positions can usually be found right in your community. People from local ski club, recreation board, council, school board, school staff, municipal employees, youth agencies, service clubs and organizations, and regional planning commissions can be contacted to sit on your committee. In most cases, a committee of five to nine people is adequate to handle the job. When recruiting committee members, advise them of the length of time they will be serving on the committee. You don't want to have to change the committee several times throughout the development process.

In some cases, the trail development project will be initiated by the municipal body. If, however, a new cross-country ski trail development group is initiating the project, the first step is to become incorporated as a nonprofit organization. This is done through Alberta Consumer and Corporate Affairs, Corporate Registry (the address is given in sources section of this manual.) It will cost money to become incorporated as a society if you complete this procedure yourself. Some organizations hire a lawyer to do the job for them, which increases the cost. The advantages of becoming incorporated are:

- An incorporated society can give tax receipts for donations of money, labour, equipment, and material.
- A society provides some identity for political and community support.
- Individuals on the committee are protected from being held legally responsible for debts or liability incurred by the organization.
- An incorporated organization can hold title to property or enter into contracts in its own name.

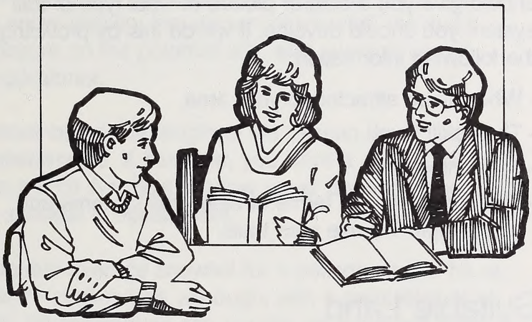
- Incorporation is usually required by grant-administering agencies.

If you are a group or club who have organized just for the development stage of the project, it may be more appropriate to use a sponsor to apply for funds and other like functions (the municipality or organization who will operate and maintain the trail may be the best sponsor).

In some cases, the expertise needed to complete your project may not be available in your community. Specialists such as a landscape architect, engineer, or construction supervisor may be required. Government consultants are also available to assist you in your trail project.

Remember, people can make the project a community project rather than an individual project. If you get the community involved, you will be more likely to create a trail that is used and supported by the community as a whole.

Developing a Project Statement



Now that you have gathered a team of people to assist in the project, the next step is to have everyone agree on what exactly the project is. To accomplish this task, the following questions should be asked:

- Who is the trail for (tourists, local people, beginner skiers, expert skiers)?
- Where is the trail going to be built?
- When is this project going to begin?
- Who is going to do the project?
- How is the project going to be accomplished?
- What type of trail will be built?
- Why do you want a trail?

By answering these questions, everyone on the committee will have a clearer understanding of the project. Five to nine people going in different directions will not accomplish much. Take the time to come up with answers to these important questions.

Having gone through this exercise, you will end up with a mission statement — a statement of objectives. The following example will give you an idea of what a mission statement may look like:

> The Dana Cross-country Ski Club is going to develop and maintain a cross-country ski trail system to serve the growing demand for cross-country ski trails by the citizens of the community. The trail will be approximately 5 kilometres in length and will serve the beginner to intermediate cross-country skiing population. It will be developed on Sec. 10, Twp. 5, Rg. 3, West 5. Planning and design to be completed by December 1987; construction to begin March 1988.

Emphasis should be placed on determining the mission statement. It gives some important details needed to see this project through from beginning to end.

Who? — The Dana Cross-country Ski Club will be taking responsibility for developing and maintaining the trail system. The municipality knows that once the ski trail is completed the responsibility for maintenance of such a trail will be carried by the cross-country ski club.

Why? — You are building the trail because of a growing demand for cross-country ski trails in contrast to building the trail because ten people want a place to ski. When you approach possible funding bodies, the reasoning and support you have for your trail system will be reviewed closely.

Where? — The location of the available land is identified. This outlines the boundaries in which to begin investigation of route selection, land ownership, and land features.

What? — A cross-country trail system will be developed that is approximately 5 kilometres long. This is important to budgets, labour, and programming.

The trail will be designed to accommodate beginner and intermediate skiers, not advanced skiers. This point is very important for assessing your trail route across the given portion of land you are developing.

When? — The trail will be planned and designed by December and construction will begin in March. Now a timetable of tasks can be set to meet those deadlines. Everyone knows that they are not planning to get the project underway in two years. You may find that once all the tasks are delegated, unrealistic deadlines are set. Be sure enough time is left for things such as submitting and reviewing grant proposals and drawing plans.

Available Market

Do you really need a 5-kilometre cross-country ski trail that is for the beginner to intermediate skier and located on that particular piece of land? The reason for such a question is to ensure that you are going to build a trail that will suit and be used by the people needing such a facility. Let's look at how to determine the answer to this question.

What you want to do is identify the interests and abilities of skiers who will use your trails. Different types of skiers require different types of trails.

Skiers' interests range from racing to maintaining fitness to general touring to wilderness touring. Their skill levels go from beginner to intermediate to advanced. This growth in skill can, in many instances, happen within a short span of two seasons.

Keep in mind that when someone takes up the sport of cross-country skiing they are generally content to ski anywhere. They do not demand a groomed trail. Novice skiers, however, do progress much faster on groomed trails. Once the basic skill level has been attained, the skier moves onto a groomed area and skis short trails of 2 to 5 kilometres. When the skiers' rhythm and stride become more skillful, it becomes important to have longer trails, which are mechanically groomed with challenging terrain where the skiers' rhythm can be maintained and developed.

In order to determine the skiers' interests and skill level for your use in planning a suitable trail system, the following methods are suggested:

a. Check with local ski clubs in your own and neighbouring communities. Find out what type of skiing their members enjoy and what percentage race, tour, or wilderness tour.
b. Find out what type of ski equipment is being sold at local sports stores.
c. Review the municipal recreation master plan for statistics on interest in cross-country skiing.
d. Send out your own questionnaire to the community.
e. Hold a public meeting.
f. Contact Cross Country Alberta for statistics on cross-country skiers (see sources section at end of manual for addresses.)

Once you have determined the type and skill level of skiers in your area, the following points should be considered:

a. How many skiers do you expect to ski on your trails? (Not all skiers will ski on your trails — some may have to travel too far or the trail system may not suit everyone's interest or ability).
b. How far will people drive to ski the trail? (A developed trail system may attract people who will drive two hours; a trail on a golf course will usually just attract local residents. The cost of travel also comes into the picture here.)
c. Who and what type of trail systems will you be competing with? (If you are attempting to draw people from greater distances, you must determine what type of facilities are available to these people within the same driving time.)
d. How accessible are your ski trails? (The type of road system that people will have to travel to get to the trail system will either encourage or discourage the potential skier.)
e. The maintenance standard expected.

The end product of all this research and questioning should give you a clearer picture of what type of trail system you should develop. It will do this by providing the following information:

- Who will be attracted to your area.
- Their skill level.
- Their interests.
- The competition in terms of other trail systems and why people will use your trails.

Suitable Land

You now have put into focus the type of trail system you wish to develop. Locating a suitable piece of land to develop is the next step.

In determining land suitability, a number of factors should be considered. These would include **legal status** (private land, Crown land, utility right-of-way); **climate** (wind, temperature, snowfall); **topography** (hills, slopes, valleys, cliffs); **environmental impact** (erosion control, wildlife); **geology** (rock outcrops, bedrock, escarpments); **soils** (types, drainage, erosion); **vegetation** (types, mature or young vegetation); **hydrology** (lakes, rivers, streams, marshes, springs); and **man-made features** (townsites, bridges, roads, railways, power/telephone lines, oil and gas wells, historical sites, etc.).

The first concern is the legal status of the land you wish to develop. Do you know if there are any restrictions on it? Get the most accurate information available on the ownership of the land. Most municipalities will have land ownership maps they use for tax purposes. Check also with the municipality to see if it has any long-term plans for the land. Find out the regulations in your area concerning public land use and land-use policies relating to trail development. Again, contacting your municipal body or regional planning commission will assist you in this area.

Once you have determined that the land has the appropriate legal status, the next step is to look at the physical and climatic features of the site (topography, vegetation, etc.). How do you go about obtaining this information and what type of information in each of these areas will be useful to you in planning your trail system? The following gives explanations about some of the key areas to be investigated:

1. Climate

Information on climatic conditions can be obtained through Environment Canada (see the sources section at the end of this manual). It also is advisable to take advantage of the knowledge about the weather from long-time residents of the area. The type of information you are looking for would be the length of the snow season, the amount of snowfall, the sun's exposure on the potential site, and average winter temperatures.

In most cases, the length of the season is predetermined. If, however, you have a choice, pick an area where the days of snow cover are fairly long and the snowfall is dependable.

Adequate average snowfall for a season should be at least 25 centimetres, although, with a great deal of work, 10 centimetres can provide an adequate base. If it snows frequently, you will be less likely to have icy trails.

When considering the sun's exposure on the piece of land, remember that a north-facing slope will retain snow longer than a south-facing slope.

Wind velocity, direction, and temperature (wind chill) will affect the use of your trail in relation to skier comfort and snow drifting (see appendix for wind-chill factors and tables).

2. Biophysical and Man-made Features

Information on the majority of these features can be obtained through five sources: aerial photographs, topographical maps, provincial land access maps, hydrological maps, and forest cover maps.

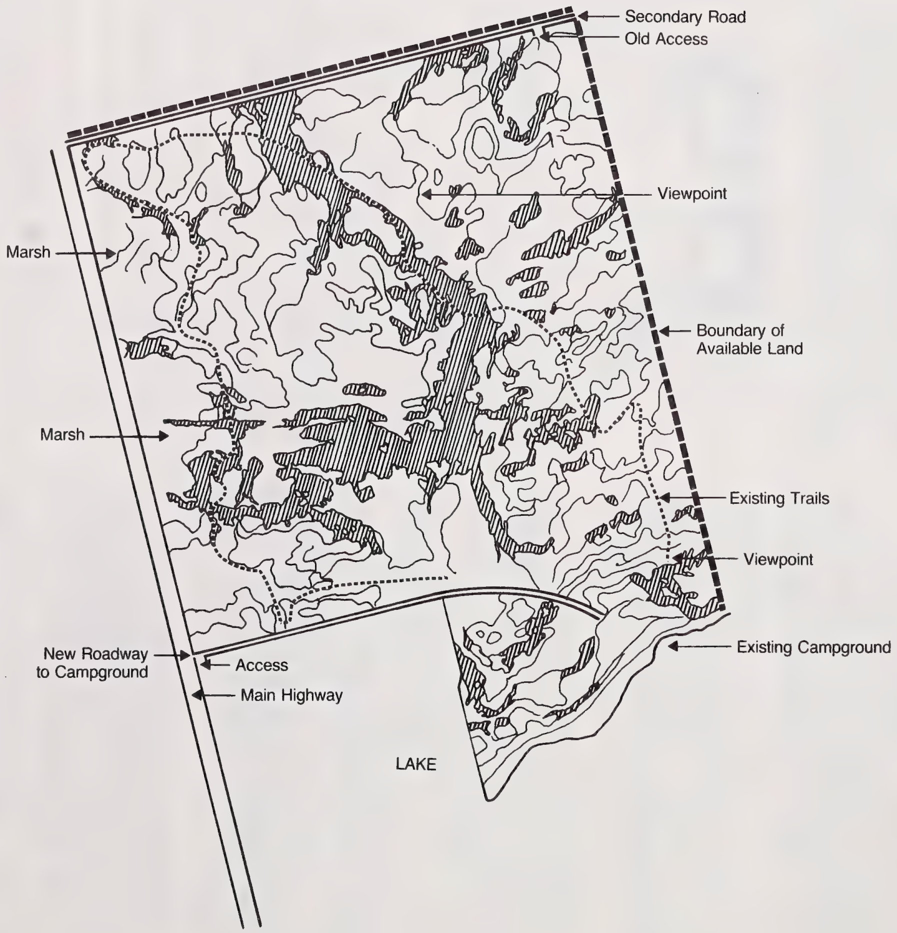
The following features can be discovered on these photographs and maps: cliffs, caves, rock outcrops, major slopes and valleys, ridges, roads and road standards, oil and gas sites, water bodies, depth of same, townsites, major park developments, golf courses, railways, existing trails/cutlines, bridges, farmsteads, and tree types and maturity, height, and area in hectares.

In order to use these maps and photos, visit the government air photograph and mapping library (see the sources section at the end of the manual for addresses).

Before you can contact any of these offices, you must have determined the legal description of the site (i.e., SE 1/4, Sec 25, Range 5, West of the 5th Meridian). Legal descriptions are shown on land title or lease documents along with the size of the parcel. When you order maps and aerial photographs, order the largest scale with as much detail as possible. Aerial photos can be enlarged six to ten times, depending on the quality of the photograph and capability of the photographic laboratory. If you order a pair of successively numbered aerial photos and use an instrument called a stereoscope (shown below), a three-dimensional picture of the land can be seen.

Pocket Stereoscope — A stereoscope used in conjunction with a stereo pair of aerial photographs permits stereoscopic or three-dimensional viewing of the terrain and facilitates trail design and layout.

After comparing the maps and photos, all the information you have derived from them should be drawn on a **base map**. The base should be uncluttered enough to permit other work to be drawn on top of it. It should be in a format that will allow easy and affordable reproduction. A base map inked on plastic film (mylar or acetate) or tracing paper can be reproduced like a blueprint. Most base maps are too large to be photocopied. Run off some working paper copies and store the original in a safe place.



YUKON PARK SKI TRAIL SYSTEM

Base Map

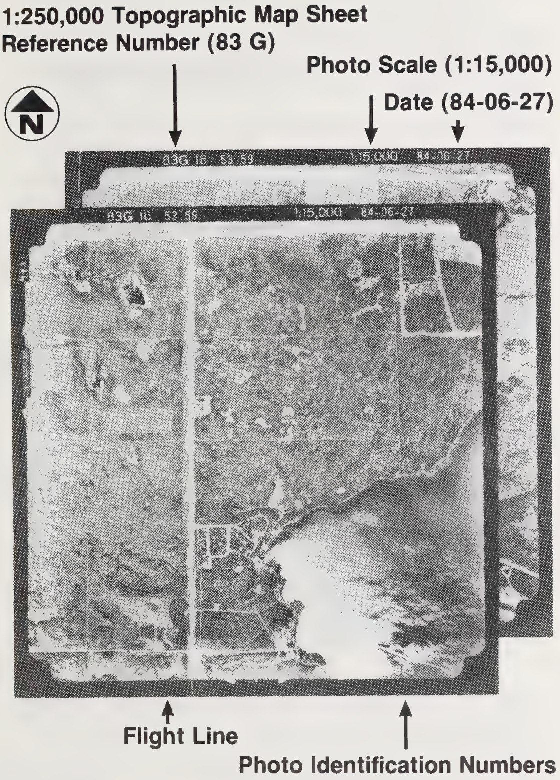
SCALE 1:15,000

N

▨ **Steep Slopes**

┅ **Existing Trails**

Air Photograph ABCs


1:250,000 Topographic Map Sheet Reference Number (83 G)
Photo Scale (1:15,000)
Date (84-06-27)
N
83G 16 53 59
1:15,000 84-06-27
Flight Line
Photo Identification Numbers

Order a pair of successively numbered photos if using a stereoscope.

Map sheet, scale, and date are usually printed at the north border of photo.

Photo scale reads: 1″ on this photo equals 15,000″ on ground (1″:834′)

Any portion of an air photo can be enlarged. To find new scale, divide original scale by the number of times enlarged.

Map and photograph reading provide a great deal of information. Now, a walk through the site will be needed to verify all of the information you obtained from the maps and photographs. Talk to local people who know the area, making use of the working copies of your base map. What you have just completed through the use of maps and the visual inspection of the site is called a **site analysis**, an idea about the physical features of the site and its relationship to the surrounding area. A clearer picture of what you have to work with for trail development will now appear.

The site analysis you have just completed is used to interpret whether or not a trail system suited to the people you identified in your mission statement can be developed.

What are some of the major items to look for in deciding whether or not the chosen land is suitable for development?

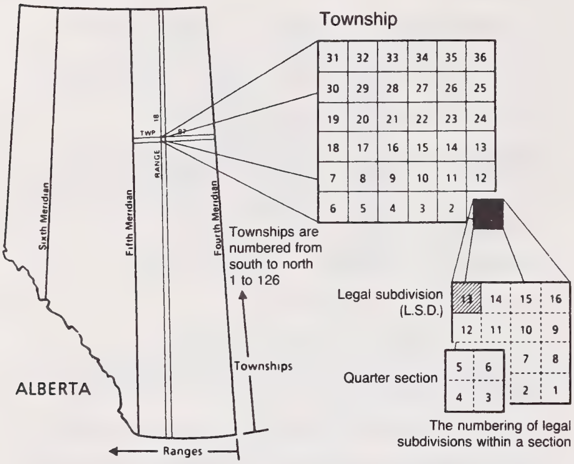
- The terrain of the land should be rolling, with an even mix of uphills, downhills, and flat terrain.
- There should be a mix of vegetation, including heavy cover, open slopes, and open meadows.
- Deciduous trees are more desirable than a tree cover of conifers (evergreens). The deciduous trees allow the trails to be open more to snowfall, resulting in a longer season.
- Adequate road access.
- The use of surrounding land.
- Space for parking and support facilities.
- Try to design the trail to avoid areas critical to wintering animal herds.
- Avoid slopes prone to snowslides and avalanches.
- The availability of an area for emergency evacuation.
- Slopes should be suited to the primary group you wish to serve (recommended slope percentages are given in the design section of this manual).
- Scenic views, historical features, and waterfalls add to the interest of the trail.
- Space for rest stops and lookout points will be needed.
- Protection from the wind must be considered.
- Look for material at the site or close by that you can use for complementary trail furnishings. Bridges, stairways, and other structures will be far more attractive if they are built from local materials.
- Slopes should not be so great that track-setting or maintaining the trail is difficult.

Keep in mind that a cross-country skil trail system can be developed using open areas like developed urban parks, golf courses, school yards, and linear green belts.

Learn to be a Map Reader

Alberta Survey System

Ranges are numbered westward from each meridian



Townships are numbered from south to north 1 to 126

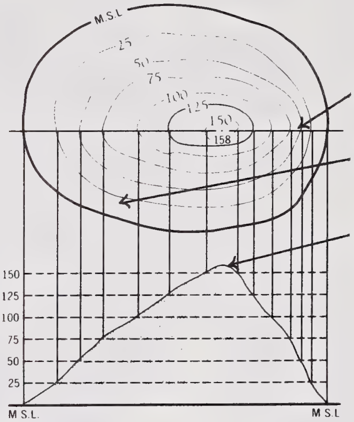
Legal subdivision (L.S.D.)

Quarter section

The numbering of legal subdivisions within a section

Topographic Maps have Contour Lines

These are drawn through points having the same elevation. They show the height of ground above sea level (M.S.L.) in either feet or metres and can be drawn at any desired interval.

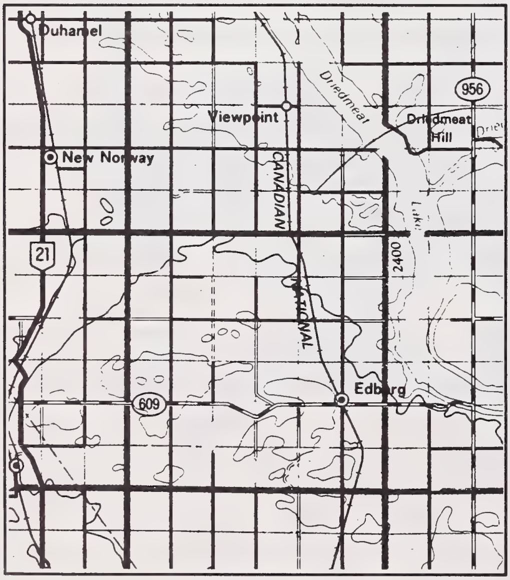


Close contour lines indicate a steep slope

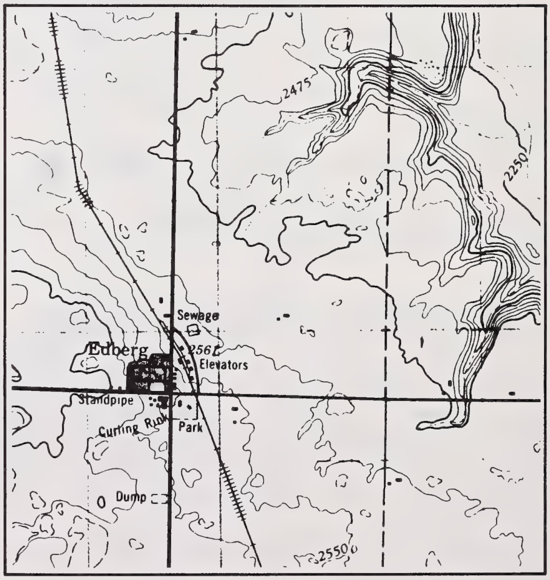
When far apart they show a gentle slope

.158

Spot heights are heights between contour lines and are shown thus .158



1:250,000 Scale Topographic Map — Good for Overview



Same Area on 1:50,000 Scale Shows More Detail

3. Concept Plan

It is now time to develop a **concept plan**. This step is a sequel to but separate from your site analysis and can be completed by your group since it is not a technical drawing. Based on the information you have collected and interpreted, draw a tentative trail on a good copy of a base map. Two trail options may be outlined. This map will indicate approximately where the trail should be routed, noting the best features and indicating points of interpretive or visual interest and structures that may be required. It is not a final design and will probably be altered several times before a final decision is made. As a concept plan, it will help you select a final route.

It is through the process of site inventory, visual site inspection, interpretation of information, and development of a concept plan that you determine whether or not the site you have chosen is suitable for development.

Is it feasible? Will you be able to construct the trail system described in your original mission statement? Will it serve the people you want to attract? If not, you may have to call a halt to the project or find an alternate site. If so, your next step is to look at acquiring the land you wish to develop.

Wherever you can, make use of public land for your trail. Otherwise, your route must cross private land. This will involve gaining permission to enter or an easement.

4. Land Acquisition

Good public relations and solid planning are keys to negotiating with private landowners. By presenting the landowners with a well laid out plan, many of their concerns will be answered and you will likely gain access to the land you require. The plan will tell the landowner exactly who your group is and what they do, where the trail will be going, how much land it will require, and that you have taken every precaution to protect their property. In a large number of cases, this permission is only given verbally. Try to get it in writing. The agreement should include the following points:

- A legal description of the piece of land you are crossing.
- The time period for permission of land use (one to ninety-nine years).
- An explanation of who will maintain the trail after construction.
- A statement of liability (a copy of the provincial legislation regarding liability is included at the end of this manual).

Finally, practise good public relations, respond to any problems immediately, have the landowners assist in laying out the final trail, involve them right from the beginning of the project, and thank them in writing (by letter and, if possible, publicly in the media).

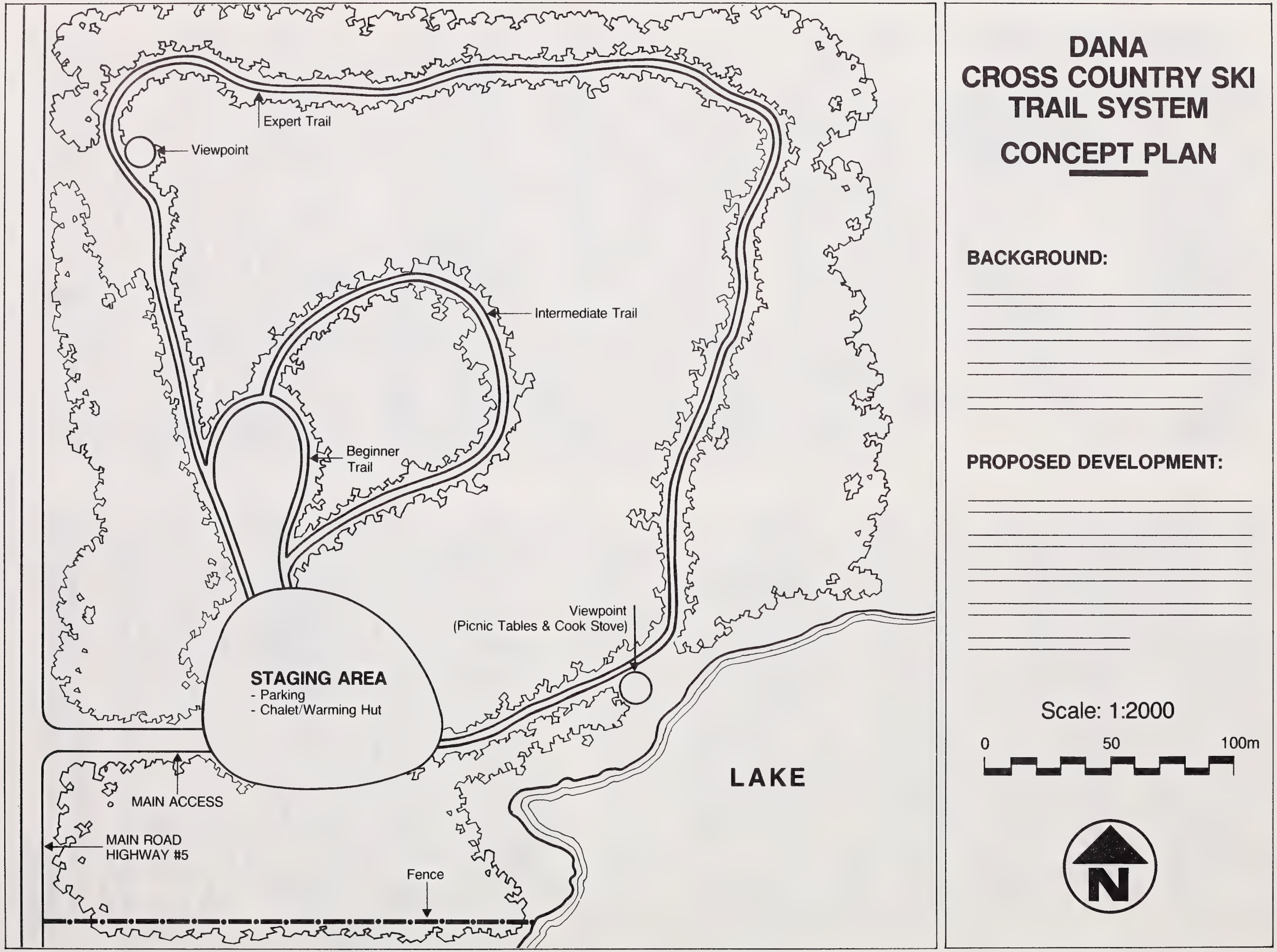
5. Public Lands

The place to identify the **public lands** you may cross is your municipal office. As mentioned previously, they have maps that show land ownership within their municipal boundaries. If you have to cross public land, the first place to call is Alberta Energy and Natural Resources, Dispositions Branch (see sources at the end of this manual for address). This branch is responsible for reviewing applications for development on public land.

If the application is successful, a land deposition will be given to you, called a Licence of Occupation for the trail and a Licence of Occupation for a staging area, if you require one. (A further explanation of this application for use of public lands is included at the end of this manual).

Other dispositions may be already in place on the land you wish to develop. If there is an existing disposition, it will take precedence over any disposition for trail development. However, in some cases, the existing use and your trail development may be compatible, and this will be taken into consideration by the land dispositions section. The following is a list of other possible dispositions that you may have to deal with:

- In a forested region (the green zone), leases for such things as logging, grazing, cutlines, and traplines (trappers are allowed snowmobile access).
- Rural electrification easements for power lines.



Ski Area Concept Plan Example

- Licences of occupation for access roads and airstrips.
- Pipeline leases.
- Recreational leases (i.e., park development).
- Licences for recovering minerals, oil, and gas and extraction of gravel.
- Right-of-ways for roads, utilities, and railways. (For information on these areas, contact Alberta Transportation — see sources at the end of manual for address — your municipality, the utility company, and the railway company.)
- If a bridge is going to be built or used, you will have to contact the federal government and/or Alberta Environment (see sources section at the end of this manual for an address.)

Investigating, choosing, and obtaining suitable land for your trail project will probably demand a great deal of your planning time. Some of the following tips may assist you in completing this task more efficiently and effectively:

- Get the private landowner on your side from the beginning. Many projects have been halted for years in the attempt to get permission to cross land.
- Plan your trail route, if possible, to avoid the problem areas you have identified.
- Use the planning expertise and written information offered by the government departments and regional planning commissions (e.g., a publication you may find useful is "Alberta Public Lands," available from Alberta Energy and Natural Resources.
- Use areas that are compatible with trail use (e.g., an abandoned right-of-way may be suitable for trail development and would save on construction costs).

6. Liability
It is a good idea to purchase liability insurance when you become involved in trail development and related recreational programs. In some cases, the municipality may cover you under their general liability insurance policy. Check with the municipality if this is a possible option.

In addition to insurance, it is prudent to practise good risk management. This is the practice of designing, constructing, and maintaining your ski trails with the safety of skiers in mind. If you are faced with a liability suit, the injured party will have to prove negligence. A trail that has been designed, constructed, and maintained with skier safety in mind may provide you with solid reasoning to disprove negligence.

The Occupiers Liability Act for Alberta is included at the end of this manual. Consult a lawyer for the interpretation of the Act regarding your specific situation.

The Canadian Ski Association carries insurance that covers its members (addresses given in sources at the end of manual). If you are a cross-country ski club, this is a major benefit to becoming a member of your provincial association. Third-party liability insurance protects the club in cases where someone attending a sanctioned ski event is injured. Second-party liability covers participant liability, whether participants are athletes, volunteers, instructors, or officials. For more information contact Cross Country Alberta (address given at the end of this manual.)

Capital Funding

You now have investigated, chosen, and acquired the land you wish to develop. A tentative concept plan for the trail route has been set and you have a general idea of what type of trails you want to develop. But how much will it cost you, and how do you determine a ball park figure? There are two ways of accomplishing this task:

- Consult government specialists involved in trail development.
- Use your network of similar trail project groups to find out what their costs were. This may include local contractors and suppliers.

Remember, be realistic and don't underestimate. The following cost estimate form will help you investigate the cost of your project:

Trail Cost Estimate Form (Sample)

The cost of your trail will be a reflection of the kind of trail you build, its design, the type of labour you use, the structures, and the finishing touches. If, after filling in this form, you find that the costs exceed your budget, remember that you can proceed in phases rather than all at once or you can build just one section of your trail.

Phase 1 - Planning

Research Materials (documents, maps, aerial photographs, etc.) $ ________
Consultant fees $ ________
Publicity materials (brochures, newsletters, advertising) $ ________
Incorporation fee $ ________
Testing fees (soils, groundwater, vegetation, etc.) $ ________
Subtotal $ ________

Phase 2 - Design

Survey fees $ ________
Landscape architect's fees $ ________
Subtotal $ ________

Phase 3 - Construction

a. Site Preparation

Tools/equipment (axes, shears, etc.) $ ________
Staking $ ________
Clearing $ ________
Stripping and stockpiling topsoil $ ________
Excavating, grading $ ________

b. Drainage Structures

Waterbars $ ________
French drains $ ________
Grade dips $ ________
Culverts $ ________

c. Erosion Control Structures

Retaining walls $ ________
Switchbacks $ ________

d. Water Crossings

Bridges $ ________
Puncheons $ ________
Corduroy $ ________

e. Trail Surfaces

Subgrade preparation $ ________
Wood chips $ ________
Gravel, limestone, shale $ ________
Concrete $ ________
Soil cement $ ________
Asphalt $ ________
Parking lots $ ________

f. Revegetation

Topsoil $ ________
Seeds/sod $ ________
Fertilizer $ ________

g. Finishing Touches

Signs $ ________
Control structures (bollards, gates, stiles, dodgeways) $ ________
Benches $ ________
Lookout platforms $ ________
Picnic tables $ ________
Fireplaces $ ________
Washrooms $ ________
Lighting $ ________
Litter Bins $ ________
Wells, running water $ ________
Warming shed $ ________
Subtotal $ ________

Phase 4 - Maintenance

Labour $ ________
Tools $ ________
Equipment $ ________
Supplies (herbicides, paint, stain, varnish, etc.) $ ________
Subtotal $ ________

Now that you have determined a ball park figure for your project, investigation into sources of funds must be done. It is important to determine the type of funding required. You will find with most trail projects that the majority of expenses are for labour unless you have difficult terrain to cross and special structures such as bridges are needed. The following is a list of funding ideas for your project. They have been divided into direct, indirect, labour-related funding and cost-saving ideas. These funding ideas, in some cases, also may apply to the operational expenses of your trail system.

1. Funding Sources and Ideas

a. Direct funding
  - Municipal funding
  - Tax revenue
  - Community Recreation/Cultural Grant Program (contact Regional Recreation Consultant)
  - Recreation, Parks, and Wildlife Foundation (telephone 482-6467)
  - Corporate and individual donations
  - Service organization donations
  - Fundraising events
  - User fees

b. Labour-related funding
  - Alberta Career Development and Employment (telephone 422-1184 or Zenith 22078):
    ABCD - Alberta Business and Community Development Program
    PEP - Priority Employment Program (winter)
    STEP - Summer Temporary Employment Program
  - Employment and Immigration Canada, Canada Job Strategy (telephone 420-4030)
  - Probation workers (community work plan)
  - Minimum security work crews

c. Indirect funding
  - Volunteer labour (from a major use group, service clubs, schools)
  - Donated expertise (legal, planning, design, or construction supervision)
  - Land donations
  - Ski club memberships or shares
  - Equipment and material donations and bulk discounts (pilot projects)
  - Cost-sharing or donations by municipality, school board, recreation board, and community organizations (administration, printing, promotions)

d. Cost-saving ideas
  - Sound planning:
    - Hire an experienced supervisor
    - Proper site selection
    - Design for low maintenance and vandal resistance in materials, finishes, and construction detailing
  - Adequate maintenance program
  - Proper liability insurance
  - Register as a nonprofit society
  - Use of local and provincial government/agency consulting resources and services

2. Applying for Grants

Locating and applying for grants can be a painstaking process. The following tips are listed to assist you:

- Obtain a copy of Alberta Municipal Affairs Booklet entitled "Municipal Assistance Programs," published yearly.
- Contact the appropriate department to make sure your project fits the mandate of the grant program.
- Record who you are talking to.
- Clarify information related to application content, procedures, and deadlines.
- Be sure your application is complete before sending it in to the granting agency.
- If you are a volunteer group, be sure you are registered under the Societies Act.
- Have previous grants accounted for.
- Be sure of general public use of your trail system.
- Ask the person you are talking to initially if they have any further suggestions on funding possibilities.

Operating Budget and Ongoing Responsibility

You have come to the point where you have determined, through your investigation of all the previous areas, that the project is feasible to construct. At this time, it is important to look past the construction stage and ask yourself, Who is going to maintain the trail, what will it cost, and where will the money come from?

Depending on the standard you have determined for maintenance, the costs will vary. Trail systems that are maintained and track-set daily may require a full-time employee. Trail systems not track-set at all may only require fall maintenance (tree clearing) that can be done by volunteers in a cross-country ski club. The key to determining the amount of money needed for trail maintenance is to determine the standard at which you want your trail system to be.

The next question is, Who is going to take the ongoing responsibility for maintaining the trail—staff or volunteers? This is a very important question, since many granting agencies will not put capital dollars into a project that does not define who will be responsible for the trail after construction.

Consider these questions very carefully. If you forsee a problem with either of them, money or ongoing responsibility, you may have to re-evaluate the project's merit.

Political and Moral Support

Political and moral support provides backing for your project without necessarily committing time or money.

A letter of support or encouragement from a local or provincially elected representative can give the project credibility and may have a snowball effect for gaining additional support. High-profile moral support may also influence other decision-makers.

The support of a local government council can be expressed as an adapted resolution or minute of their official proceedings. Arrange to be placed on the agenda to make a presentation on your proposed trail project. You will be taken more seriously if you are well organized and present ideas that have been carefully thought out. This is where all your previous planning work can really pay off.

Keep your supporters and the community as a whole informed as the project planning progresses and, later, as construction progresses. Update them periodically through a newsletter or an article in the newspaper. Hold a public meeting or meetings to outline your plans. Remember to have an official opening. Publicize it well and give contributors and supporters an opportunity to make a brief presentation. In some cases, the opening has been used as a fundraiser and has included such events as races or barbeques.

Is Your Project Feasible?

A great deal of work has gone into the planning stage of your project. It is now time to ask whether the project is feasible or not based on the information you have gathered.

The following are questions you must be able to answer in order to proceed with the design and construction of your trail system. Do you have:

	YES	NO
- an able and willing committee	☐	☐
- a clear and agreed-upon project statement	☐	☐
- a market for the trail system	☐	☐
- suitable land	☐	☐
- capital funding	☐	☐
- operation funding and ongoing responsibility	☐	☐
- political and moral support	☐	☐

A Note on Volunteers

In most cases, trail projects are initiated and carried through by volunteers. They are one of the most important assets you will have if you are developing a trail system. Care must be taken to treat them right. Sloppy use of volunteers will mean increased frustration and decreased enthusiasm. The following are some tips to ensure proper volunteer care:

- After recruiting volunteers, be sure they have one boss to answer to. There is nothing more frustrating then getting conflicting messages.
- Give each volunteer a written job description of what tasks will be expected of her or him.
- Be available to answer questions and address concerns.
- Reward them for what they have done (volunteer appreciation night, pins, passes, etc. — build this into your budget at the outset of your project).
- Allow them to quit gracefully if they indicate that the project is not their cup of tea.
- Ask them for their advice and input since they are close to the project.

A Note on Hiring Professionals

Hiring a Pro

Once your committee has investigated all the areas monitored in this section and determined that the project is feasible, you are well prepared to hire a professional consultant to assist in the planning and design of your trail system. The further ahead you are thinking, the more the consultant's product will match your needs and expectations. Try to avoid paying an outside consultant to make recommendations that you could have come up with yourself.

Professional help can be costly, so use it only when you stand to gain from the investment. Here is what it can buy:

- Independent viewpoints: Consultants have a fresh, outsiders' perspective on your project that may help resolve complications.
- Professional expertise: Consulting firms have a wide range of experience to draw on and specialized skills to apply to your particular needs.
- Resources: A consultant may have to be hired if you lack the resources to do it yourself.

Always weigh an expert's opinion carefully. Be open to new ideas and suggestions, but don't give up on what your preliminary work has told you.

Consultants

Look for a consulting firm that will work **for** you and **with** you (a manual, "Selecting and Working with Consultants," is available through Alberta Recreation and Parks). Here is a brief description of a happy client-consultant relationship:

1. The committee writes a **terms of reference** outlining the work to be done. Who, what, where, and how are the questions to ask about the relationship of the volunteer group and the consultant. What, exactly, is the consultant expected to do? If the consultant is developing the trail system with the help of local volunteers, the request for proposals should let the consultant know that he/she has to be willing to accept the project on that basis. Some like to do the work themselves.
2. A request for proposals is sent to several qualified consulting firms. Proposals should include:
   - description of the firm;
   - outline of related experience and client references;
   - background of the personnel who would do the work;
   - a description of how the work would be done;
   - a project timetable; and
   - the cost to the client, including all fees and expenses.
3. The committee reviews the proposals, checks references, and chooses several firms for interviews.
4. Interviews with selected consulting firms are conducted.
5. A consulting firm is chosen and agreements are signed.
6. The committee supervises the work, with periodic meetings scheduled with the consultant to review progress and give approvals, if required.
7. The work is reviewed, modified if required, and accepted.

Planning - A Summary

The planning portion of your project will form the foundation for successful development. Key to the planning process is determining project feasibility. In order to make this decision, seven key areas must be considered: an able and willing committee, an agreed-to project statement, an available market, suitable land, capital funding, operational funding and ongoing responsibility, and, lastly, political and moral support.

Ideally, a committee should consist of five to nine people representative of a cross-section of your community. Skills one would look for in this committee selection would include leadership (chairperson), writing (secretarial), financial (treasurer), construction (equipment operator), knowlege of the sport (cross-country skier), and administration (municipal representative). If you are a volunteer group, it is suggested that you register as a non-profit organization or go under an umbrella organization already registered under this act.

All the members of the committee will, as one of their first tasks, need to develop and agree upon a project statement. This project statement answers the questions of who the trail is for, where it is going to be built, who is going to build the trail, and why it is going to be built? The answers to these questions will form a project statement and will act as a guide as you develop your trails.

Is there really a need for the trail system? In order to determine the need and market, one must review the different interests and abilities of the cross-country skiers in your area. Once those are determined, factors such as driving time, accessibility, and competition from other ski areas must be considered.

Finding suitable land for your development will depend on a number of criteria. These include legal status, climate, topography, environmental impact, geology, soils, vegetation, hydrology, and man-made features. Various methods are used to collect this information. This would include aerial photographs, topographical maps, forest-cover maps, talking to the local people of the area, and walking the site. Collecting this information is called a site analysis. As it is collected, it is plotted on a lease map. From this lease map you can begin to plot a tentative trail system which considers all the factors mentioned above. This is called a preliminary concept plan. Land acquisition can involve a great deal of time and red tape, whether it is private or public. Begin working on this task early in your project. Consideration should also be given to buying liability insurance for both developing and operating your facility.

There are various sources of financial assistance. These would include direct funding (grants), labour-related funding assistance (minimum security work crews), indirect funding (material donations), and cost-saving ideas (a good supervisor can save you money). Whichever method or methods you choose, your need for funding should be based on an estimated budget.

After the ribbon is cut, how is the trail going to be maintained and by whom? These questions must be answered in your planning stage.

Support for your project, both political and moral, provides you with backing without, necessarily, a commitment of time and money. That kind of support can lend credibility to your project and can have a snowball effect, gaining additional support of money and/or time. Always keep the public and decision-makers of your community abreast of how the project is proceeding.

Are enough of the above-mentioned seven components satisfied for you to go ahead with the project? It is critical to honestly answer this question before detailed work is done.

Volunteers can be an asset to your project. Care must be taken to treat them right. Be sure they have only one boss to answer to, give them a complete job description, and reward them for their time and effort.

Professionals can cost money, but in the long run they may save you money. Where local expertise is not available, hiring a professional may be required. If this is the case, your committee should follow this procedure: write up terms of reference; send out a request for proposals, review proposals, and interview candidates; sign a contract; and supervise the work so that it is done to your satisfaction.

The front-end work of the planning process can take a great deal of time and effort. Once it is completed, however, and your project is determined feasible, you can enter the design phase confident that you have a sound foundation for your development.

DESIGN

Introduction

You now have formed your committee and your work group and have hired a consultant or decided not to. What's the next step?

From here, you move to the design phase of your project. This is where you take the information you have so far and develop it to a point where your labour force (volunteers, hired) can begin the process of constructing the trail.

To get to that point, a number of factors must be investigated and a certain sequence of steps must be taken. The following is an outline of those steps:

- Gather all relevant information from the planning portion of your project.
- Take the preliminary concept plan and have a development plan drawn up based on suggested standards and various design considerations (site, user, maintenance, and money available for capital costs).
- Development of detailed working drawings of such items as chalets, picnic tables, toilets, etc.

By completing these steps, you will be able to begin the actual construction of the trail system. A great deal of work will have gone into the project by this time—work that will give you the satisfaction of knowing that you are going to build a trail that will be satisfying to the people who use it.

Each of these steps will now be explained in further detail.

Use of Planning Information

Gather all the relevent information from the planning portion of this exercise. This would include the project statement, the results of the market survey, the site analysis map, the concept plan, and a rough budget estimate. This information will be important to completing the next step of design.

Developing a Plan

The development plan is a plan drawn to accurately show the location of all development. This should be drawn up to a 1:500 to 1:2000 scale in the 2 to 5 feet contour intervals. A cost may be involved in obtaining this type of detailed information. Many projects, depending on their complexity, make do with 7.5 metre contour interval map and extensive walking of the proposed trail system. Other projects have made use of the orienteering club in the community to map out the area in .5 to 1.5 metre contour intervals.

The development plan will take into consideration the direction given to you in your project statement and market analysis, suggested standards for cross-country ski trails, and various design considerations including the site, the user, maintenance, and capital money available for the project. It would include the following details:

- All roads are drawn to scale and are shown in their final location.
- All trails are drawn to scale and shown in their final location.
- Parking areas are drawn to scale to accommodate the required number and type of vehicles.
- Structures are shown in their preferred location, with outlines of large structures drawn to scale.
- The location of visitor services, such as toilets, warming shed, and firewood bins are shown in their preferred location.
- Trail management requirements are detailed, including the location of grooming equipment storage, etc.

In order to come up with an accurate development plan, you or a hired professional will begin by reviewing the mission statement and the market information and by studying the aerial photographs, topographical maps, forest cover maps, site analysis maps, and concept plan.

If your trail system is relatively uncomplicated and is being done by a volunteer crew under the supervision of an experienced supervisor, it may be possible to lay out your trail just by using the concept plan. You would lay out the trail alignment and make field adjustments as required **without** going through the development plan stage. However, a development plan and/or detailed drawings are required if construction is contracted out.

The Site

Many site factors are related to the design of the trail system and support facilities. The following are some of these factors:

Summary of Design Features to Consider

Features to Avoid

1. Areas of steep slope (see page 21 slope percentages)	• long, steep slopes too strenuous and unsafe • flat ground is monotonous • difficult to groom • avalanche potential • result in broken stride
2. Exposed south or southwest slopes	• early snow loss • crusting conditions • increased maintenance costs for exposed areas
3. Northwest slope	• winds may sweep bare • increased wind chill • (trees will lessen these effects)
4. Swampy areas	• shortened season • often remain open during winter • rapid growth of underbrush • environmentally sensitive
5. Poorly drained areas	• will cause wet trails and ice spots • shortened season
6. Drainage channels, outside of river bends, around large rocks in water, where river enters or leaves lake, or where stream enters river below rapids	• ice is thinnest at these points • increased trail construction costs due to bridges or culverts • less than 10 centimetres of ice should not be skied on • season is shortened considerably at these points
7. Open fields or lakes	• flat ground is monotonous • wind chill factor • often windswept (snow is blown off trails) • can be an excellent area for teaching and for starting large races

Features to Avoid

8. Long and steep side slope traverses	• makes diagonal stride difficult • difficult to groom • high construction costs
9. Sharp digs and turns	• hazardous • result in broken stride • difficult to groom
10. Thick groves of conifers	• prevent snow from reaching ground • snow melting off branches causes ice on trail • shed needles that stick to ski wax in warm weather
11. Roads and fences	• dangerous to cross • roads damage skis and remove wax • cause skiers to break stride
12. Uneven ground surface	• high construction costs • uneven trails require more snow and more grooming
13. Trail beneath cliff faces	• falling ice dangerous to skiers, especially in spring

Features to Include

1. Varied terrain and variety of grade, approximately one-third uphill, one-third downhill, one-third flat	• variety prevents monotony
2. Points of historical, geographical, or environmental interest	• makes trails more interesting
3. Treed northern slopes	• snow will remain later into spring • less crusting of snow
4. Vista and views	• increase visitor experience

Environmental considerations such as soil erosion, vegetation, water, and wildlife must be reviewed in your trail design.

Soils and their ability to withstand weight and erosion must be evaluated. The soils that do not withstand weight, such as those in a swampy area, may eventually cause depressions in your trail bed. Fine-grained soils such as clay, silt, and fine sand are unsusceptible to erosion. Erosion can be partially controlled by minimizing the alteration of natural drainage systems and natural vegetation cover. If this is to be achieved, culverts and drainage ditches must be constructed.

Vegetation removal not only promotes erosion but can be aesthetically displeasing to the skier. Other factors to consider about vegetation include winter kill, wind throw, wind scald, and sun scorch.

Winter kill is the damage and killing of vegetation caused by compacting snow (resulting from ski tracks). Wind throw is caused by the clearing of shallow roots in forested areas. As a result of clearing, the trees next to the trail will fall. Wind scald and sun scorch result from trail clearing and the killing of low plants that are resistant to the effects of wind and sun.

You can avoid these problems by revegetating areas of exposed soils after construction, moving the trail, where possible, and planting hardy varieties of grass to avoid winter kill. For wind throw, place your trail in a position that enters the forest in the same direction as prevailing winds and only clear the trail wide enough to allow for safe and enjoyable skiing.

Water, both the water table and water quality, should be considered when designing the trail and support facilities. Avoid high water table areas such as swampy land. this is a very fragile ecosystem and is not a solid base for trail development. Water quality is important if you are planning to construct support facilities such as a chalet. Sewage systems for such facilities must also be considered.

Wildlife feeding grounds, water holes, and trails should be avoided. If you do so, wildlife are more apt to stay in the area, and nature interpretation and wildlife viewing can become an added attraction of your trail system. Some drawbacks to wildlife presence are tracks and feces on your trail. They also may attract hunters.

Field investigation of these factors should take place and be divided into two categories: winter or snow cover investigation, and summer or snow-free investigation.

By investigating your site at various times of the year, different types of information can be obtained:

- Winter investigation
    - Depth of snow.
    - Condition of snow (crusted, wind-packed).
    - Areas blown bare of snow.
    - Drainage channels or wet areas that remain open or are periodically open throughout the winter.
    - Areas of high wind chill.
    - Areas showing evidence of snowslides.
- Summer investigation
    - Small areas of unacceptable topographical slope.
    - Bedrock outcrops.
    - Uneven ground surface.
    - Erodible soil.
    - Areas of poor drainage.
    - Tree types to be avoided.
    - Sensitive or unique vegetation communities.

Through field investigations, the length of season can be anticipated and optimum skier comfort and safety can be planned. It will also verify the assumptions made through the review of maps and aerial photographs.

Access to your area is important to the design of your project. Considering the fact that the activity you are promoting is a winter activity, do the roads require renovation to control snow and accommodate snow-removal equipment? If a new road or renovations to the old are required, you must determine the cost. The quality of your road access will determine whether or not people will come to your site.

Adequate room for development should always be considered. Does the land area you have chosen have adequate space for trail development, parking and support facility development, and possible future expansion?

Trail length and layout will be determined in part by the size of the land. For example, if you are going to build a trail for the expert skier, you will have to have a great deal more trail length than what is needed for a beginner trail. Trail length will be discussed further in this manual.

A great deal of suitable space is required for support facility development and parking. The area has to be relatively flat and the soil must be suitable for construction purposes for such things as chalets and be able to take the weight of vehicles for parking.

Future expansion is one consideration often overlooked. Is there room for future trail development? It may require additional land. If so, what are the

surrounding land uses? Expansion of trails, in most cases, will mean an increase in skiers. Will the support facilities and parking areas be able to accommodate this increase or will they have be expanded? Will the area that is available for trail expansion suit your needs? Consider the skier you want to attract.

During the design of your trail, future expansion should be investigated and a phasing of construction should be laid out.

Multi-use of trails is always good promotion of your ski trail system. If multi-use is being considered, plans must be made to accommodate those activities. Design considerations for other uses can be found in the "Recreational Trails" manual of this Focus Series of resource material (see back cover).

Proximity to utilities can enhance the area's potential. If you are planning to light your trails or operate a chalet, access to power and telephone are important. Check the nearest access to these utilities. There is additional expense in bringing in either of these utilities any great distance. In some areas, on-site generation is used to provide power to facilities.

These factors and the information in the following tables can be used to guide you through the process of identifying the pros and cons in the design of your trail system.

The User

The second design consideration is the people who will be using your trail system. Skier ability, interest, and safety must be always kept in mind in the design of your trails. This, in turn, translates into the following items:

- The type of programs you will offer the skier and what type of space is required (e.g., teaching area).
- The type and size of support facilities you will develop.
- The trail standards you will follow (grades, width, length, alignment, and clearance).
- The type of trail layouts you have (stacked loop, maze, etc.).
- The type of structures you will develop (toilets, signs, etc.).

As explained earlier in this manual, skiers have very different needs based on their skill level and interests. For example, a beginner skier requires a much less challenging trail than does the experienced skier. At this point, you review your mission statement and market analysis information. It is from this information that you reaffirm the type of skier you want to attract and the type of trail system you are going to develop.

Once you have made definite decisions, designing the trail and support facilities can begin. Trail standards and layouts will have to be discussed at this point.

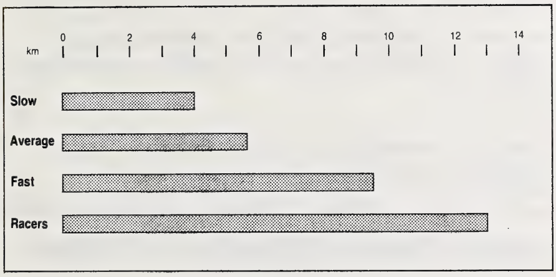
The following is a list of items to be considered under each category:

1. Trail Standards

a. Length

The length of the trail will be determined by the ability of the skier. Listed below are recorded average distances covered in an hour by various categories of skiers. These distances can be used as a basis for calculating trail length.

Categories of Skiers/Average Distance Covered/Hr



Slow tourers	2-4 km/h
Average tourers	5-5.6 km/h
Fast tourers	8-9.5 km/h
Racers	9.5-13 km/h

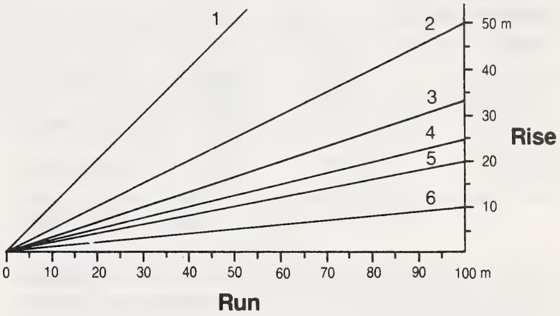
The amount of time a skier participates will have an effect on your trail lengths. Participation is based on skill level. The following are some suggested blocks of time to use when determining trail lengths.

- sports/fitness skiers use one-hour blocks
- weekend tourists use two-to-three-hour blocks
- novice skiers use one-hour blocks

b. Slope or grade

Percentage grade is the ratio between the vertical rise and the horizontal run. A 100 per cent grade is the same as 45 degrees. See figure below for rise/run examples.

Slope Percentage/Grade Chart



1 1:1 or 100% or 45°
2 1:2 or 50% or 27°
3 1:3 or 33% or 18°
4 1:4 or 25% or 14°
5 1:5 or 20% or 11°
6 1:10 or 10% or 6°

For general use trails, the following guidelines can be used:

Greatest sustained gradient (over 100 metres trail length)	12 - 15%
Greatest short gradient (under 30 metres trail length)	20 - 25%
Average desirable gradient	0 - 10%

For more detailed trail design and construction, the following standards are suggested:

MAXIMUM TRAIL GRADES — STRAIGHT TRAIL, NO TURNS *

	Gradients		
Experience Level	**Sustained 30 m or longer**	**Short 10 - 30 m**	**Very Short Less than 10 m**
Easy	8%	12%	12%
Moderate	12%	20%	30%
Difficult	17%	25%	30 - 40%

* Boise National Forest

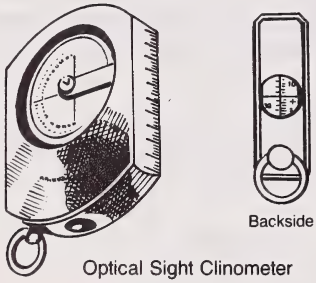
Tip — If when walking down a slope you find yourself braking or being jarred, it is at maximum steepness for an intermediate skier.

Avalanches are most common on slopes between 25 and 45 degrees. If you are planning trails in the foothills or mountains, a careful assessment of suspect slopes should be made. Try to avoid potential avalanche areas. If your trails are located in suspect areas, be sure to consult with individuals who are recognized for their expertise in assessing avalanche hazards.

c. Optical sight clinometer

The optical sight clinometer may be used during preliminary field reconnaissance or final trail alignment to measure topographic slope and may facilitate the preliminary determination of the ratio of slope to flat ground and maximum grades. It is also useful in rating trails for ability level. The scale is graduated in both degrees and percentage slope.

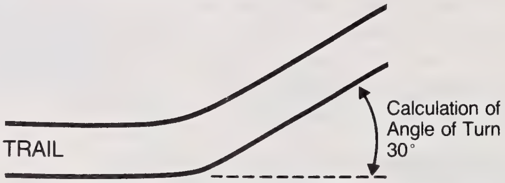
The majority of trail planners rely on eyeing and walking the terrain to determine areas that are too steep or corners that are too sharp for the average skier.


Backside

Optical Sight Clinometer

d. Trail alignment

As the steepness of a hill increases, so does the area required for turning at the bottom. Trail alignment, combined with slope and width, determine the difficulty rating of trails.



Runouts should be provided on sharp turns that occur at the bottom of steep slopes. Turns in excess of 90 degrees are acceptable on very gentle traverses (similar to switchbacks on hiking trails) or on one-way uphill trails.

If you are concerned about a detailed alignment analysis, you can consult the following chart:

ANGLE OF TURN AND MINIMUM TRAIL WIDTHS *

Grade / Turn	**0° - 30° Minimum Trail Width**	**30° - 60° Minimum Trail Width**	**60°+ Minimum Trail Width**
0 - 18%	1.5 - 3 m	1.5 - 3.6 m	1-8 - 4.2 m
8 - 12%	3 - 3.6 m	3.6 - 4.2 m	4.2 m with runout
12 - 20%	3.6 - 4.2 m	4.2 m with runout	4.2 with runout
20 - 40%	4.2 - 6.4 m	4.2 - 6.4 m with runout	No Turns

* Boise National Forest

e. Width

The trail should allow unobstructed passage for skiers and grooming equipment and provide a clear view down the trail.

Some guidelines are:

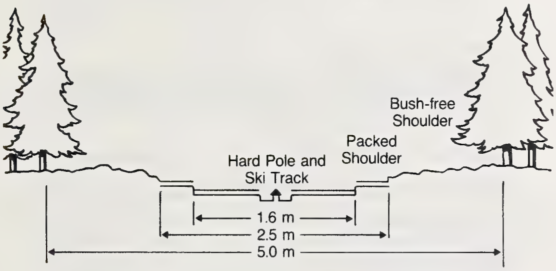
	Touring trails	**Racing trails**
Flat	4 m minimum	3.5 m minimum
Hills	6 m minimum	3.5 - 4.5 m minimum

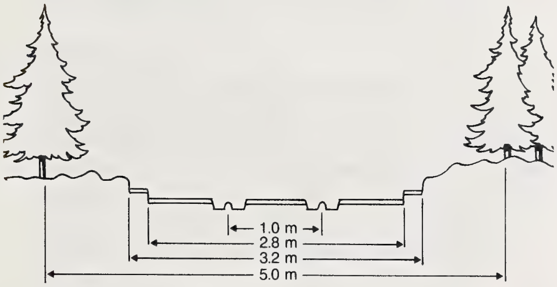
A good perspective of trail widths for single and double tracks is shown below.

Notice that the **clearing** width is 5 metres; however, the width of level trail is 1.6 to 3.2 metres.

The extra cleared width ensures:
- safety of skiers who may fall to the side of the trail; and
- that coniferous tree cover will not minimize snow cover.

Note: These trail widths do not take into account the technique of skating. Increased trail widths may be required to accommodate this technique.





Intersections

- should be level and flat (< 5 per cent slope)
- should be cleared to two times the dimension of the intersecting trails
- must be pre-marked
- a T or Y junction is preferable to a +

Competitions

- a mass start (lappet) or lesson area 25 metres wide by 250 metres long can handle a one-hundred-skier start or three fifteen-student classes

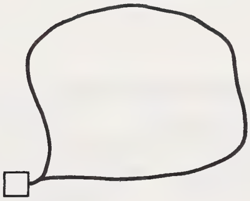
f. Clearance

In heavily forested areas, care should be taken to clear overhanging branches to a height of at least 3.5 metres, especially in good snowfall areas. This will be determined partly by the height of snow cover on your trail.

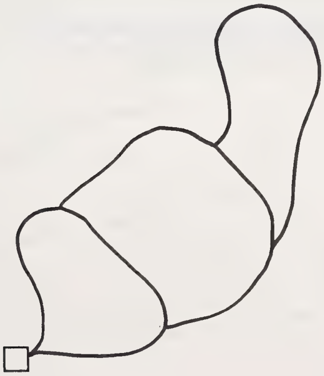
2. Trail Layout

The trail layout will be a result of user needs, the applicability of existing terrain, and optimum use of the area. A good layout should emphasize the uniqueness of the area and each trail, while minimizing potential for confusion or boredom. Maximizing the distance between trail intersections (minimum 500 metres) and eliminating maze-like systems is important.

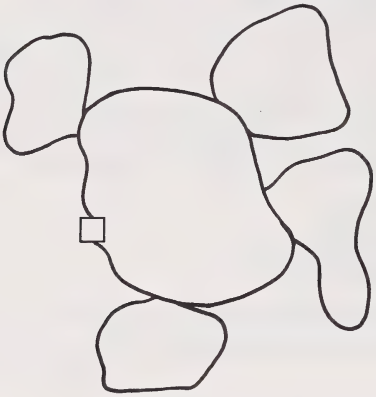
a. Simple loop
- Good initial trail.
- Minimum signs.
- Becomes boring to skiers.
- Suited for partial day use.



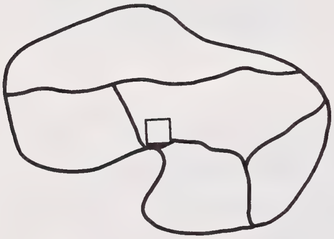
b. Stacked loop
- Good use of small area.
- New trails easily added.
- Partial or full day use.
- Variety of trails.
- Cutoffs and intersections must be well marked.



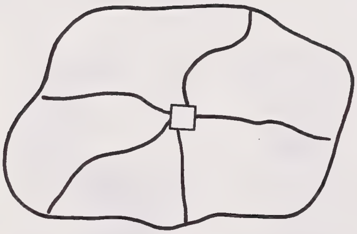
c. Loop with satellites
- Variety of trails.
- Partial or full day use.
- Disperses users.
- Requires clear signs.
- Permits closure for maintenance or special uses and provides shortest emergency access.



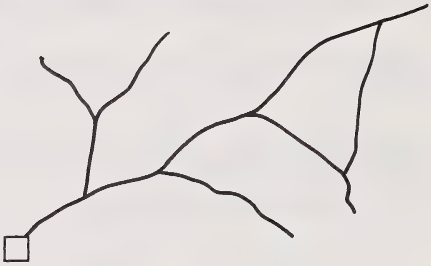
d. Maze
- Optimum use of a small area.
- Must be well marked.



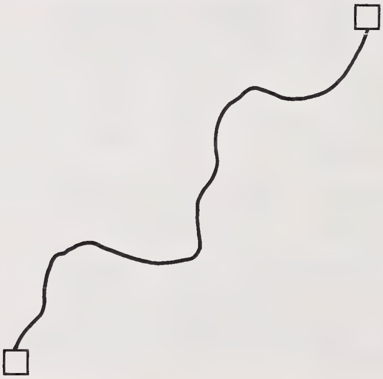
e. Spoked loop
- Makes good use of available area.
- Two-way traffic on all trails.



f. Branched system
- Outgrowth of a system along a logging road or old trail.
- Can be developed into a loop system.
- Must be two way.
- Wilderness trail.



g. Point to point system
- Can be expanded to more extensive system.
- Shelters needed if long.
- Minimum signs required.
- Good if shuttles are available.
- Must be two way.
- Wilderness trail.



Some last tips on trail layout:

- Turns should be widened and slightly banked to assist the skier in turning, especially going downhill.
- On slopes, sufficient clearance should be allowed for the safety of falling skiers and to allow skiers room to herringbone or sidestep up. This will also provide space for ascending skiers to step out of the way of downhill skiers.
- On slopes exceeding 10 per cent, curves should be banked and left clear of trees in order to allow skiers to stop safely.
- On long runs, widened sections should be provided at intervals to allow skiers to control their speed or run off the trail.

3. Rating Trails for Degrees of Difficulty

To ensure the safety of skiers, trails should be marked to indicate the degree of expertise required. The base loop of a trail system should be suitable for novices, while secondary loops can be used to provide conditions suitable for more experienced skiers. The following identifies more specifically the types of conditions required by different types of skiers:

a. Novice

Downhill runs should have a maximum grade of 10 per cent. Trails crossing slopes diagonally should be wide and gentle. Several short slopes are preferable to long slopes. With short slopes, speeds do not become too great and climbing is not tiring. Descents with steep side slopes are difficult for inexperienced skiers and should be avoided.

Remember to include flat, open areas where beginners can practise techniques.

b. Intermediate

Maximum grade for downhill slopes should be 25 per cent. Curves may be sharp, but ample room should be left for over-shooting. Up to one-third of the trail may be uphill with some steep but short climbs. There should be a maximum single elevation gain of 50 metres and less than 300 metres of climbing per 15 kilometres of trail.

c. Expert

Maximum grade for downhill slopes should be 40 per cent. Gentler grades should be used on long runs where the trail surface is rough or where there are sharp curves. Adequate runout distance should be provided at the bottom of steep or long slopes. Up to one-half of the trail may be uphill. There should be a maximum single elevation gain of 75 metres.

Note: Trail rating should be based on the most difficult point along a certain route. An expert trail may be skiable by a beginner, especially over flat terrain, but if there is even one steep slope on the route it should be designated as an expert or advanced run at the trailhead, so that beginners do not end up getting stranded far down the trail.

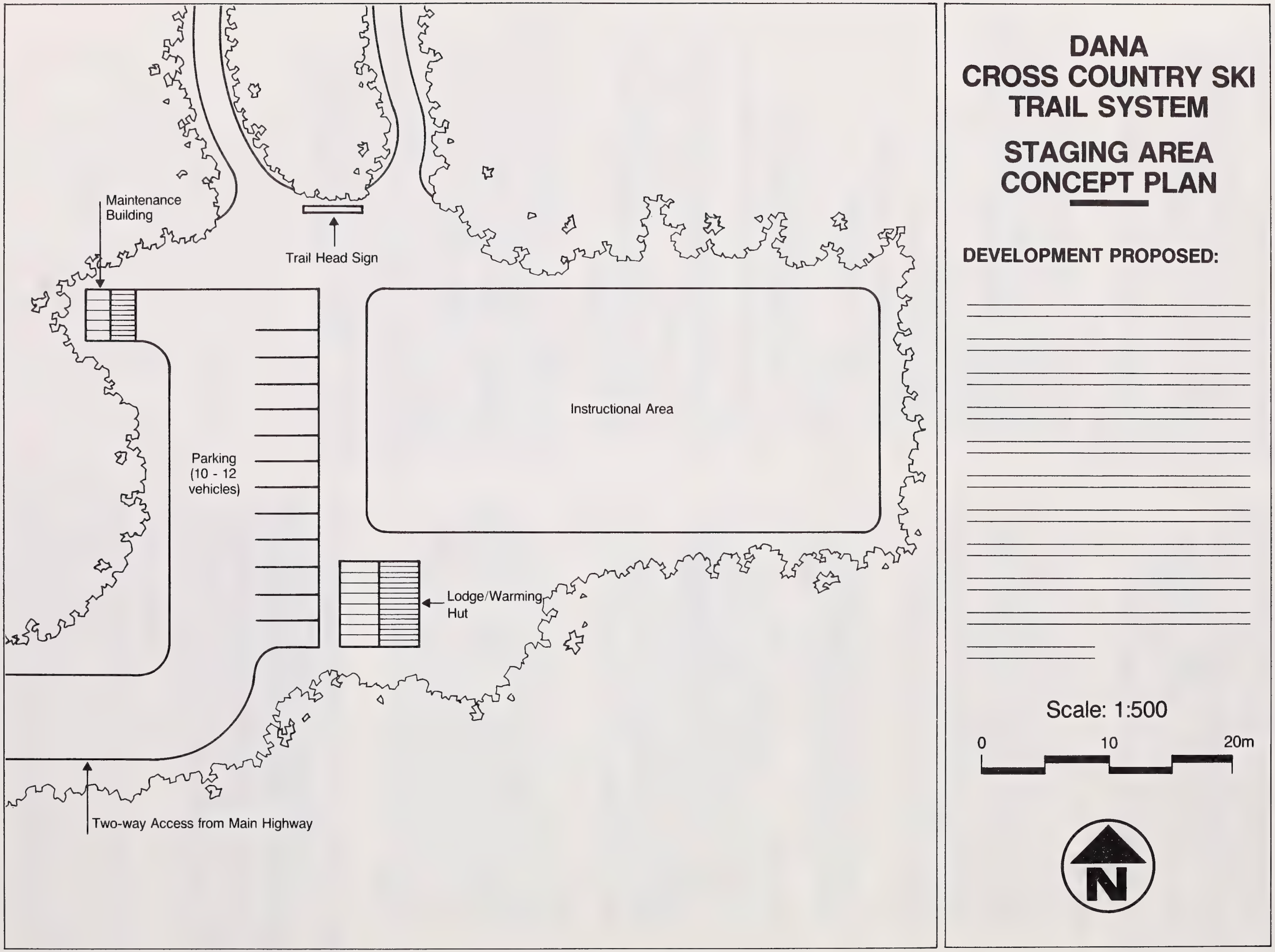
4. Support Facilities (Staging Area)

The next step is to consider the design factors for the area where support facilities (staging area) are to be developed. The staging area is the location where skiers will begin and end their ski activity. They will decide which trail to ski at this point.

A number of items should be considered in this design:

- Making the best use of the site.
- The programs that will be offered. For example, when organizing special events and presentations, there should be a large and level open area in the staging area.
- Area to handle maintenance equipment.
- Services area development.
- Circulation of vehicles and pedestrians.
- Future expansion possibilities.
- Security.
- Facilities or structures should be located immediately adjacent to the parking lot.
- If constructing a shelter, consider insulating the floor.
- Consider the time and money that will be required for maintenance.
- Co-ordinate your structure and signage by using one standard design. It looks good and gives you an individual identity.

If an instructional area is included (both for flat terrain skiing and hill skiing), it should be located close to the staging area. In cold weather, students and instructors can easily ski to the shelter or to their vehicles to warm up. The design of staging areas facilities can range from the basic (parking lot, pit toilets) to the deluxe (ski lodge and competitive facilities). Design specifications for buildings and other facilities can be developed for you by a professional or you can look at and modify designs from existing areas or from information provided by government consultants.



**DANA
CROSS COUNTRY SKI
TRAIL SYSTEM**

**STAGING AREA
CONCEPT PLAN**

DEVELOPMENT PROPOSED:

Scale: 1:500

Staging Area Concept Plan Example

5. Additional Considerations in User Design

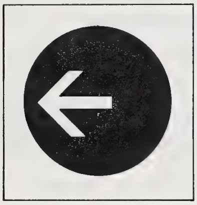
a. Signs

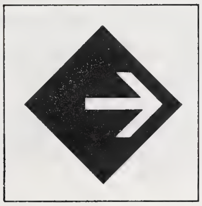
Signs will be an important feature of your ski trail. Signage should follow an accepted format to minimize confusion, opportunities for injury, or liability for losses. Signs should include:

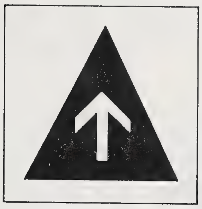
- At trail head — For one trail: name, length, and degree of difficulty. For multitrails: maps of all trails, lengths, locations of natural features, and facilities.
- At junctions — Names of intersecting trails and directions to points of interest and difficulty and length of each trail.
- Directions.
- Warning of hazards.
- Location of shelters, toilets, and water courses, and the nearest telephone in case of emergency.

The following are examples of signs used to express degrees of difficulty and other trail factors:

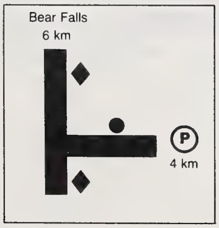
Signage


Easy GREEN

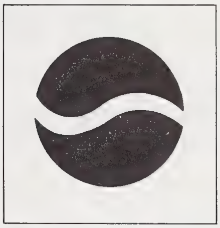

Intermediate BLUE

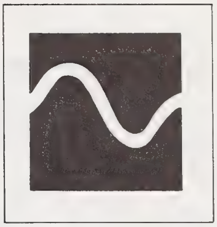

Advanced RED

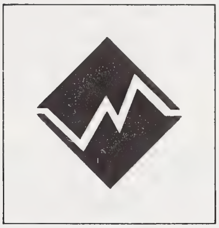
These two systems (specific colours and symbols) for rating trail difficulty are both used. However, the colour rating is by far the most common.



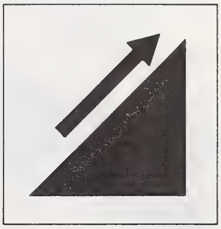
Proper placement of this type of sign is very important.

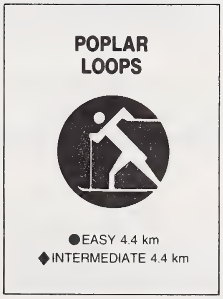

Easy


More Difficult


Most Difficult

Directional Arrow


Hill Symbol



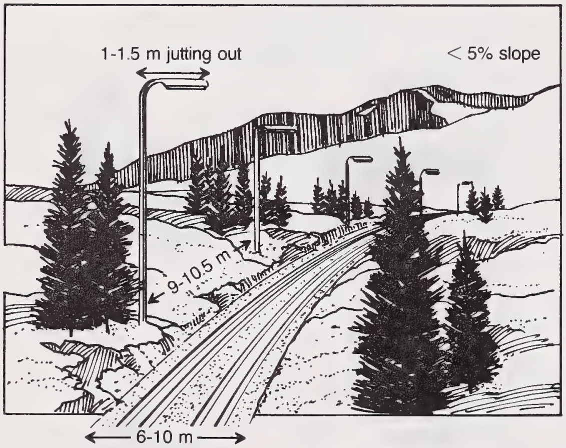
Signs can be made locally using simple designs as illustrated here, or they can be obtained from certain distributors or agencies. Sometimes the breweries distribute small styrofoam directional signs as part of their winter promotion program. The provincial or national ski associations may also give you sources for signs.

b. Lighted trails

The addition of lights on a short section of your trail can provide a bonus to recreational skiers and racers alike. With our short winter days, lighting for three or four hours in the evening can double or triple the use your trail receives during the week. Timers and coin-operated systems could be considered.

The best location to light is a one-way loop, with a maximum elevation of 5 per cent. Make sure all curves are wide. Even a short section of 2 kilometres can be attractive to night skiers. Trails must be wider than normal (6 to 10 metres) and free of obstruction.

Poles are set 9 to 10.5 metres apart. Their height will be 8 to 10 metres, with features jutting out 1 to 1.5 metres from the pole. Poles are located on the outside of curves (see diagram below).



Ski trails require lighting that will give a low glare and a wide distribution of light. Low pressure sodium or low wattage high pressure sodium lamps have been used successfully.

If your trails are located in town, take advantage of existing street lighting. Try approaching your local power company for expertise. With a good public relations plan, you may even be successful in negotiating a materials donation.

c. Other structures

Other structures that may be required include bridges, rest stops, benches, camp stoves, wood bins, shelters, gates, machine loading ramps, lockers, and race course start and finish areas. Designs for these structures should be obtained through a government consultant or other existing facilities.

Maintenance Concerns

The design of your ski trail system should take into account the ease and cost of maintaining that system.

Ski trails, if you anticipate grooming and track-setting them, will have to be a minimum of 2.5 metres wide. For tracking equipment to negotiate the trail system, sharp turns and steep slopes must be avoided. If these factors cannot be avoided, plan not to track-set these sections. In some cases, depending upon the skier you wish to attract, you may not wish to set track.

Depending upon the complexity of your support facilities and structures, maintenance costs will vary greatly (a large chalet will require more maintenance than a small warm-up hut).

The following are some tips about designing for easy maintenance:

- Unclutter and uncomplicate. Strive for simple design solutions that minimize visitor frustration.
- Design facilities that are easy and safe to maintain.
- Standardize fixtures, signs, and materials to streamline maintenance requirements.
- Make short-lived or easily damaged materials and fixtures convenient to repair and replace.
- Don't pass on design faults, construction problems, and poor workmanship to the operating budget to be fixed later.

When selecting materials, consider the following:

- Fire resistance.
- Durability.
- Appearance.
- Availability.
- Ability to take and hold a finish.
- Climatic adaptability.
- Drain ability.
- Clean ability.
- Vandal proof and easy to repair.
- Uniformity (Is it complementary to other materials used in your trail system?).

Capital Funding

In the design of your trail system, the amount of money you have available to you can be a limiting factor. To assist in cutting costs the following tips are provided:

- Avoid areas where a great deal of earth work will have to be done to place the trail.
- Avoid muskeg areas where trail construction would be costly.
- Avoid, as much as possible, areas where large tree stands will have to be cleared.
- Avoid areas that will require diversion of the natural water drainage system. The installation of culverts can be expensive.
- Wherever possible, use existing access roads. Road construction is an expensive item.
- Determine the standard of your trail system. It may be less costly to clear a 2.5-metre wide trail than a 4-metre wide trail. However, while clearing a 2.5-metre trail may be cheaper, off-season maintenance of a 4-metre trail is easier because full-sized vehicles can travel the route.
- Determine the standard of support facilities and structures. What type of material are you going to be using (for example, gravelling a parking lot is a lot cheaper than paving it)? Remember also that all your project does not have to be built at once. Phasing the project according to your financial capabilities may allow you to complete the project, even if it takes a longer period of time.

Plotting Your Decisions on a Development Plan

You have reviewed many design factors about the site, the user, maintenance, and the capital funding available. From this review, decisions will be made on the final placement of the trail and support facilities and structures. This information will then be placed on your development plan, which will be used in the construction of your project.

The following is an example of a finished development plan. Points pertaining to developing a plan were discussed earlier in this chapter.

Detailed Working Drawings (optional)

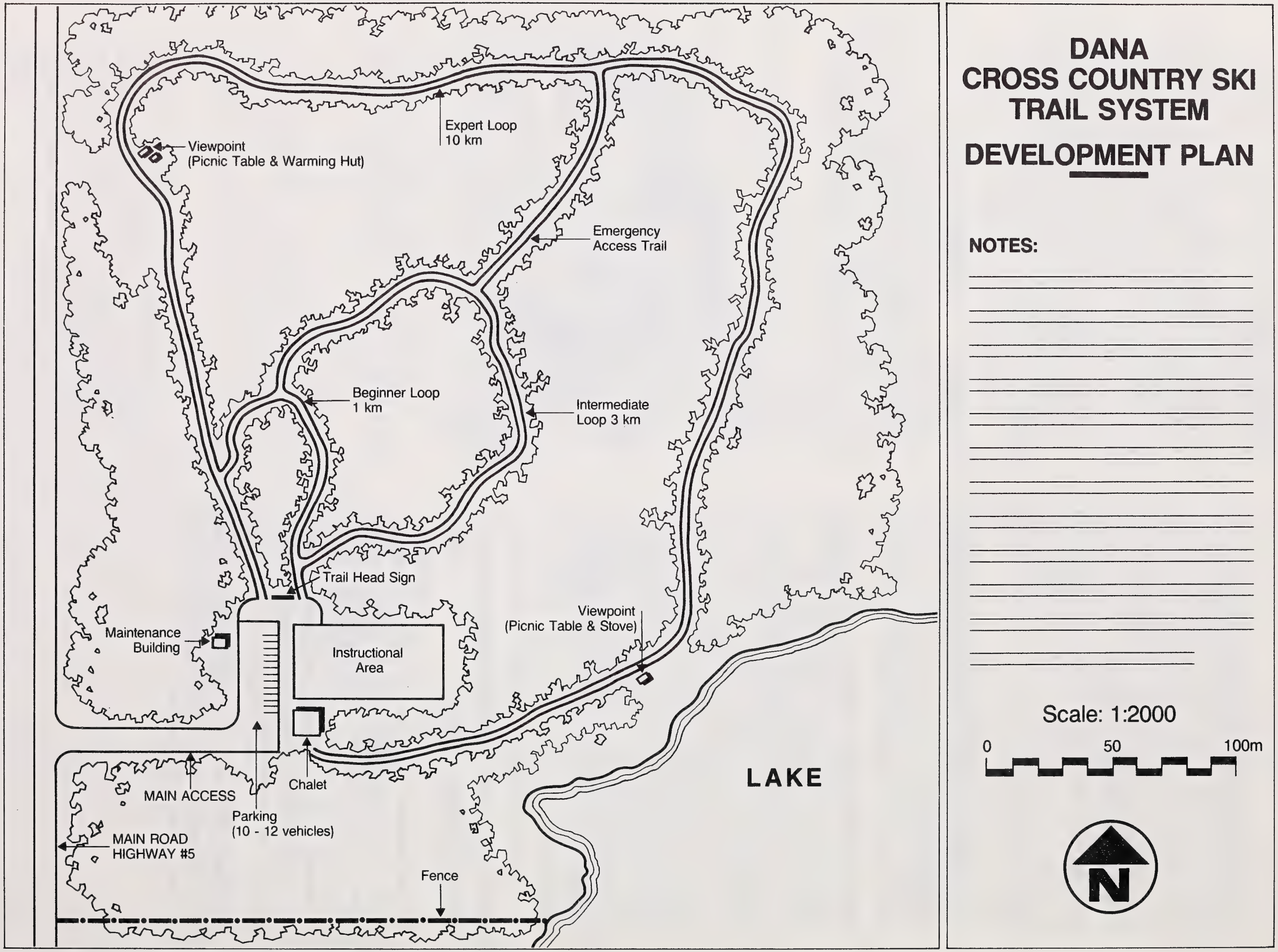
This step in the process is optional, depending upon the complexity of your trail project. If you are building a trail system and support facilities that are quite sophisticated, hiring someone to do detailed drawings will be required. This may include such features as a ski chalet, bridges, retaining walls, and the installation of culverts. Search for designs used by other ski areas and consult your government consultants for additional ideas.

Design — A Summary

Through the process of design, you have accomplished a great deal. You have tried, to the best of your ability and available resources, to have a trail and support facility design plan that has taken into consideration:

- the site — you have made the best use of the land you are developing;
- the user — you have taken into consideration skier safety, ability, comfort, and interest;
- maintenance — you have developed the trail and facilities to allow ease and low cost of maintenance; and
- capital dollars — you have made the best use of the capital money available.

Lastly, you have followed a process that resulted in the drawing of a development plan. A plan that can now be used by the labour you have (either volunteer or hired) in the actual construction of your trail system.



Ski Area Development Plan Example

CONSTRUCTION

Introduction

Finally, you get to see some of the hard work of planning and design translated on to the actual site. Having done the paperwork will result in a more efficient development plan construction, saving you money in the long run.

In this section, the following steps will be reviewed:

- Organizing your troops.
- Flagging the trail and noting construction work to be completed.
- Preparing a final budget.
- Clearing the trail.
- Preparing the trail.
- Constructing support facilities and structures.
- Revegetation and landscaping.

By completing the above-mentioned steps, your end product will be a trail system ready for snow and skiers.

Organizing Your Troops

This is the time to look at your labour needs. You will need the following:

- Someone to flag the trail — If possible, make use of the person who will be heading your work crew. You may require someone with the expertise for reading a development plan and translating it on to the ground.
- A supervisor for the work crew — This expertise may have to be hired, or a volunteer familiar with trail projects may be used.
- A work crew — A hired or volunteer work crew of three to five people will be needed. It is advantageous to recruit people who are familiar with the operation of power tools.
- Heavy-equipment operator — Depending on the magnitude and complexity of your project, you may require such a person.

If you decide to use hired staff for this portion of the project, a general contractor also should be hired.

The general contractor is the person responsible for seeing that the development plan is built as shown. This person is also responsible for billing, paying, and supervising all subcontractors hired to do specialized work (electrical, plumbing, earth-moving, etc.).

Hiring a general contractor involves the same steps as hiring a consultant. A terms of reference is prepared, bids are solicited, and a contract is entered into. Remember that the lowest bid may not be the best one. The contractor's experience, skill, and ability to work with and supervise others must also be carefully evaluated.

A consulting company experienced in trail system development may provide you with cost savings by using experts who can cover more than one of the required positions. For instance, one person may be able to flag the trail and act as the general contractor.

Ask for references, and visit other projects the contractor has worked on. Make sure you know the reliability and reputation of any contractor you hire.

The contract is a legally binding document once both parties have signed it. Get it in writing, and seek legal advice before signing the contract. A contract is meant to protect both sides. Make sure the terms are specific: the client will receive what was promised at the agreed price, and the contractor will be paid a fixed amount for a specific piece of work. Vague contracts can be real nightmares.

The following would be included in a typical contract:

- The names and addresses of the **buyer** (the committee) and the **seller** (the contractor).
- A detailed description of the work to be done, quantities involved, materials to be used, and quality of work required.
- An assurance that all work will be done according to locally applicable codes and regulations.

- A clear statement of liabilities assumed by each party (public liability, workers' compensation, property damage, etc.).
- The details of handing over the site, final inspection, approval of completed work, and site cleanup.
- The start and completion dates.
- The price and means of payment.
- A statement of all warranties and maintenance periods, explaining exactly what is covered and for how long.
- The special conditions that would lead the buyer to terminate the contract.
- The details of how additions or changes can be made to the contract.

Most contract work includes a **holdback** of 15 per cent of the total contract fee as a final payment. The holdback is paid after enough time has elapsed to ensure that the work has been performed satisfactorily and that there are no outstanding claims by subcontractors and workers. Holdback percentages vary from province to province.

Flagging the Trail

To flag a trail accurately, your development plan will have to be followed very closely. This is the time where someone experienced with map, compass, and terrain can be of great value. Many communities have had people familiar with the sport of orienteering assist them with this aspect of trail development. It is also wise, as mentioned previously, to have the construction supervisor in on this exercise. He or she should have a knowledge of what type of construction techniques will work best in which spots along the proposed trail.

As you walk the proposed trail, it is important to remain flexible about the trail route. No matter how much paper work and planning has gone on before, during this exercise unforeseen obstacles may arise. Make sure property markers are checked so that the trail doesn't in part or whole end up in the wrong place.

To flag the trail, make use of the recommendations you formulated in the design stage of the project. The table on page 18 in the design portion of this manual provides some general guidelines. Again, keep in mind your mission statement, skier interest, ability and safety, and the maintenance of the trail after it is completed.

The trail should be walked in both directions. Slopes should be measured with an optical sight clinometer as mentioned earlier in this manual. Rough distances can be paced. A pace is defined as a double step and one pace is counted each time the left or right foot is put down, whichever is preferred. The length of an average pace is 1.5 metres but will vary with each individual. Take into consideration that your pace will shorten as the day ends and you have done a lot of walking and that different terrain will affect your step.

To mark the trail, plastic surveyor's tape should be used. To avoid unnecessary tree clearing, it may be necessary to flag the centre of the trail along with the trees on the edge of the trail. The disadvantage of

Trail Construction Evaluation Sheet

TRAIL SECTION	VEGETATION ON CLEARING WIDTH	EXISTING TRAIL	PROPOSED TRAIL TYPE	STRUCTURES	WORK REQUIRED	COST ESTIMATE
-0-90	**Moderate Pine	Nil	Citizens Trail	Nil	- Moderate clearing & trail preparation	90m @ $5/m = $450.00
-90-900	*Dense Willow	Nil	Citizens Trail	Nil	- Major clearing of willow and minor lease preparation	510m/$7/m = $5,670.00
-900-1430	*Sparse Willow	Nil	Citizens Trail	- 2m Bridge at 900	- Bridge construction and surfacing - Minor clearing of willows	530m @ $3/m = $1,590 Bridge & Surfacing = $380.00
-1430-1650	Clear	Game Trail	Citizens Trail	- 10 m Bridge at 1600	- No clearing, moderate bridge construction and surfacing	200m @ $1/m =$200.00 Bridge & Surfacing = $1,000.00
-1650-1700	**Moderate Pine	Nil	Citizens Trail	Nil	- Moderate clearing & surface preparation	50m x 5/m = $250.00
-1700-3100	Clear	Game Trail	Citizens Trail	- 5m Bridge at 2200	- Minor clearing & surface prep - Minor bridge construction and surfacing	1,400m @ 1/1m = $1,4000.00
						Total **$10,940.00**

* Small Timber (up to 10 cm in diameter)
** Medium Timber (10 -20 cm in diameter)
*** Large Timber (over 20 cm in diameter)

centre flagging is that you may lose the trail if you remove the flagged tree. Sometimes, offset flagging is done to avoid this—one side of the trail is flagged at a predetermined offset distance from the actual trail edge.

It is also important at this stage to take a notebook along to note the type of construction that will be required in each section of the trail. This information will not only be helpful to the work crew but will also give you the basis to formulate your final budget. The above example gives you a way of recording this information.

With this type of explanation and a properly flagged trail, the actual trail construction is outlined and can easily be referred to by the construction supervisor or the work crew.

The best time to flag a trail is when there are no leaves on the trees. This will give you a much clearer, unobstructed view of the area you are going to cover.

Preparing a Final Budget

In the planning of this trail system, you roughly estimated how much the project will cost. Now, it is time to finalize these estimates and develop a final budget for your project. This budget should include four distinct areas: planning, design, construction, and maintenance.

By including these four areas in your final budget, you will get a clear picture of whether or not you can afford everything in the development plan, before you dig. You may realize you can't do it all at once. You'll see where to cut back on, modify, or delay a future phase. It will be necessary to include a copy of this budget with most grant applications. Lastly, it will give you a reference point for evaluating contractors' bids and will give you justification for ongoing fundraising efforts. The following is an example of a trail budget form:

Expenses

Planning

Research materials (documents, maps, aerial photos) $ ________
Consultant fees $ ________
Publicity materials (brochures, newsletters, advertising) $ ________
Incorporation fee $ ________
Testing fees (soils, groundwater, vegetation) $ ________
Booking $ ________
Insurance $ ________
Subtotal $ ________

Design

Survey fees $ ________
Trail designer or landscape architect's fees $ ________
Subtotal $ ________

Construction

a. Site Preparation

Tools/equipment/supplies (axes, shears, gas) $ ________
Staking $ ________
Clearing $ ________
Stripping and stockpiling topsoil $ ________
Excavating, grading $ ________

b. Drainage Structures

Waterbars $ ________
French drains $ ________
Grade dips $ ________
Culverts $ ________
Drainage ditches $ ________

c. Erosion Control Structures

Retaining walls $ ________

d. Water Crossings

Bridges $ ________
Turnpikes $ ________
Puncheons $ ________
Corduroy $ ________

e. Trail Surfaces

Drainage fabric $ ________
Subgrade preparation $ ________
Wood chips $ ________
Gravel, limestone, shale $ ________
Concrete $ ________
Soil cement $ ________
Asphalt $ ________
Parking lots $ ________

f. Revegetation

Topsoil $ ________
Seeds/sod $ ________
Mulch $ ________
Fertilizer $ ________

g. Finishing Touches

Signs $ ________
Control structures (bollards, gates, stiles, dodgeways) $ ________
Benches $ ________
Lookout platforms $ ________
Picnic tables $ ________
Fireplaces $ ________
Washrooms $ ________
Lighting $ ________
Litter bins $ ________
Ski racks $ ________
Waxing thermometer $ ________
Fencing $ ________
Wells, running water $ ________
Chalet, warming hut $ ________
Subtotal $ ________

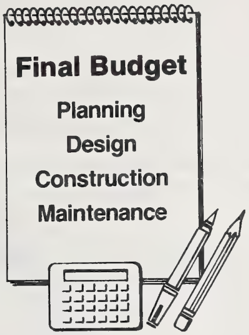
Maintenance

Tracksetter $ ________
Snowmobile $ ________
Renovator $ ________
Wages $ ________
Fuel $ ________
Subtotal $ ________

Total Expenses $ ________

Revenue

Municipal grant $ ________
Club memberships $ ________
Fund-raising events $ ________
Cash on hand $ ________
Total $ ________



Use the following tips when developing this budget:

- Consider reviewing the points given on page 12 dealing with developing design standards based on the amount of capital dollars available to you.
- Get more than one cost estimate from different contractors and suppliers.
- Include the cost of materials, labour, and shipping costs, and federal sales tax.
- Remember that the lowest bid is not necessarily the best (you may have to sacrifice quality).
- Shop around locally.
- Talk to managers of similar projects and get some figures on the cost of their project.
- Contact your government representatives for assistance with project details.
- Be sure the cost estimate is signed, and make note of the time before the estimate lapses — it will vary from one to three months.
- Review the design standards you have set for trail and support facility development (for example, trail width, material standards for warming hut).

A good budget is one of the key components to any granting agency's application. Care in preparing a detailed budget gives agencies an outline of why the money is needed and on what it will be spent. If your budget does not balance, explain why and if you are phasing the project. It is important to see that the grant money goes to a project that will be completed and used.

Clearing the Trail

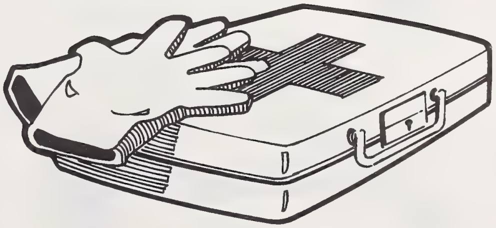
Although this section deals with clearing for trail construction, the same methods can be used for the support facilities areas. Note that many communities share facilities between groups. An example is a golf course-clubhouse-cross-country ski club building.

First of all, you must identify the resources required:

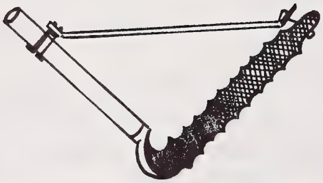
- Workers — a work crew of five to six people is advantageous (see p. 37).
- First-aid kit.
- Proper clothing for the crew — steel-toed work boots.
- Tools — hand tools (chain saw, gas-powered brush cutter, brush hooks or saws with extensions, axe).
- Polaski or forester's axe (excellent tools for removing stumps, rocks, and roots).
- Fine rake (used for removing forest litter from surface of trail).
- Pruning shears (used to cut branches or small saplings up to 2 centimetres in length).
- Chain saw (used to cut larger trees).
- Mechanized equipment — small garden tractor, trailer, bobcat, trailblazer (less than 1.5-metre blades).
- Heavy-duty equipment (backhoe digger).
- Caterpillar D4 (2.7-metre blade).
- Garden tractor with trailer (if you cannot get standard-sized vehicles on your trail, the garden tractor is good for hauling workers and tools).
- ATC with dump box or trailer.
- Snowmobile with sled.
- Portable rock crusher.
- Wood chipper (to shred wood, which can be used on the base of your trail).
- Backhoe digger (used to dig culverts or foundations).

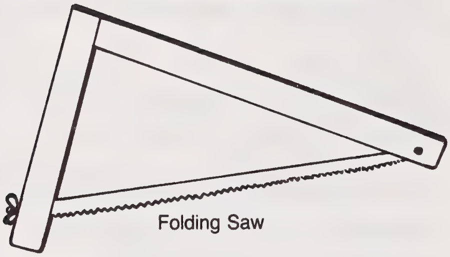
Remember, before you dig, call Alberta 1-800-242-3447. Also check with Alberta Culture to make sure you will not damage buried historical resources (427-2020).

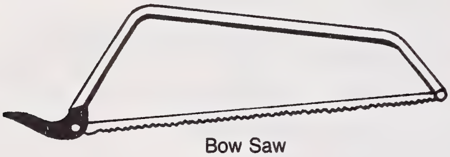
The use of heavy-duty equipment can cause extensive erosion.

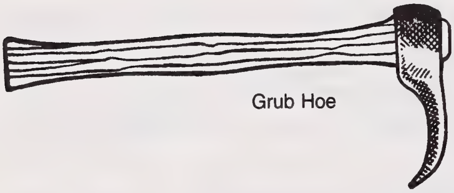


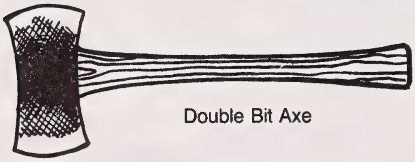
Trail Clearing Tools

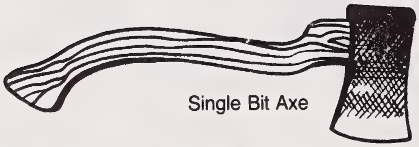

Reinforced Brush Slasher

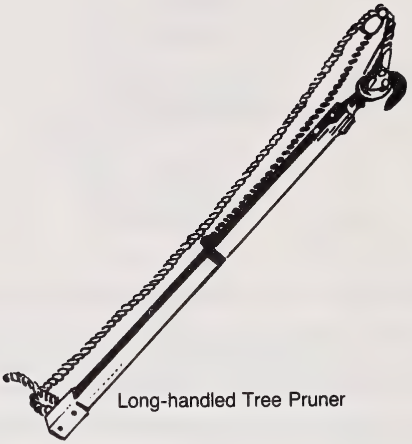

Folding Saw

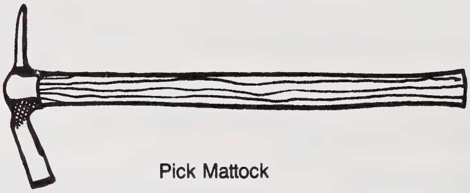

Bow Saw

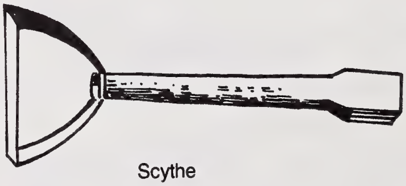

Grub Hoe

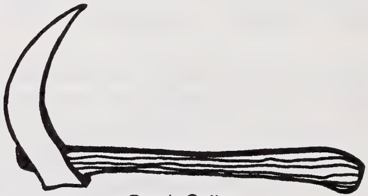

Double Bit Axe

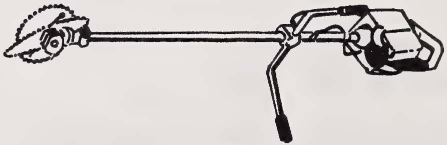

Single Bit Axe


Long-handled Tree Pruner


Pick Mattock


Scythe


Brush Cutter


Brush Whip

The Steps in Clearing a Trail

Begin clearing your trail route by orienting the work crew, whether they are hired or volunteer. The items to cover in an orientation should include:

- if your work crew is hired, the assurance that all pertinent forms are completed (for example, worker's compensation);
- the assurance that all the crew understand their job functions and are familiar with the use of the equipment they are handling;
- a review of the development plan and the metre-by-metre explanation of the work required;
- a review of the design of the trail and the standards set (for example, height, width, length, and slope); and
- a demonstration of how to use unfamiliar equipment.

After you and/or your supervisor have gone through the orientation, clearing the trail can begin. The following sequence of events should take place:

- The first person uses a chain saw to cut all the flagged major trees and logs.
- The second person goes through with a saw and cuts small saplings and protruding branches from standing trees.
- The third person either cuts the fallen trees and logs up for firewood and stacks them, or the trees are pulled to the side of the trail. Some projects have all trees and debris hauled to central stockpiling areas. Some use this wood for trail construction, like retaining walls. When clearing debris, throw it to the downside of a slope, outside the clearing limits. This will assist in erosion control.
- The fourth person goes through with a brush cutter and clips all the small brush along the trail.
- The fifth person makes use of polaski or forester's axe and digs out stumps, roots, and rocks along the trail. Stumps to the sides of the trail should only be cut to ground level.
- The sixth person clears small debris off to the sides of the trail. (This should be scattered past the edge of the trail to avoid huge, ugly piles of debris.)

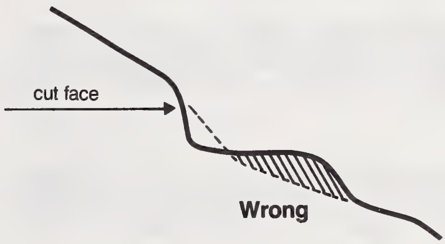
Note that some of these jobs will be doubled up with a work crew of less than six people.

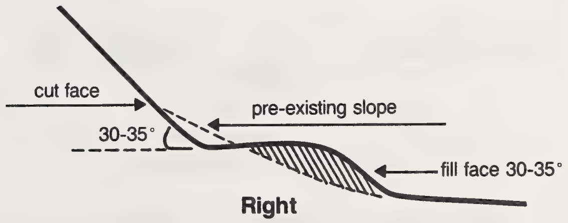
Preparing the Trail

Grading, Drainage, and Erosion Control

As the clearing is done, the supervisor should note the areas where special machinery and construction techniques will be needed, especially if the trail is going to be used in the off season.

- Across streams — If your trail will be multi-use, bridges of some kind must be installed. Bridges should be as wide as the trail. Contact Alberta Environment for approval of such structures. For smaller streams, logs cut from the trail can be placed across the stream wide enough for ski-grooming equipment to cross.
- Across hollows and clumps — The trail should be level across its entire width. These should be graded by hand or machine.
- Along hillsides — They are levelled by using the cut-and-fill technique.
  a. Cut into the sideslope to create the backslope above the trail clearing.
  b. Fill in below the cut to produce a bench.
  c. Slope the downhill side of the trail to reduce erosion later.



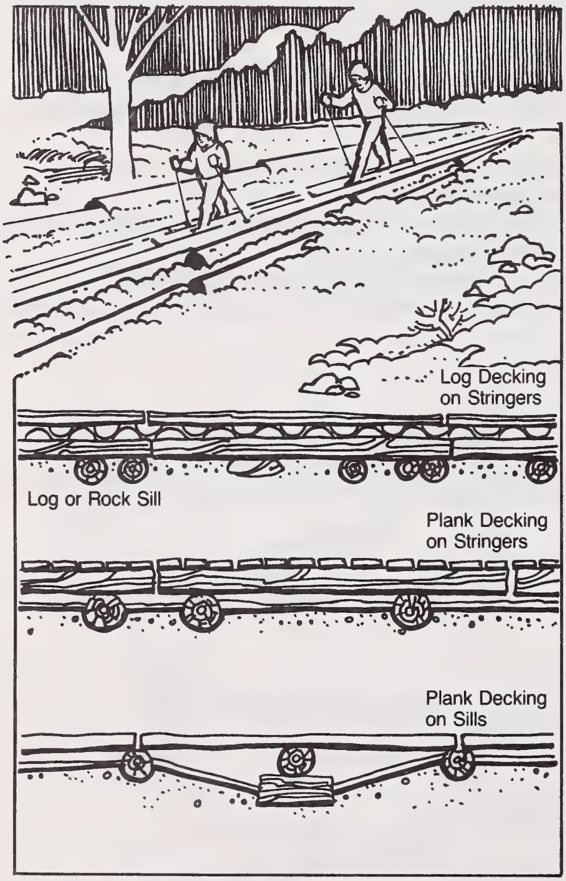


- Swampy and soft spots — Although these are not much trouble, some extra construction methods will extend your season and make the trail multi-use.

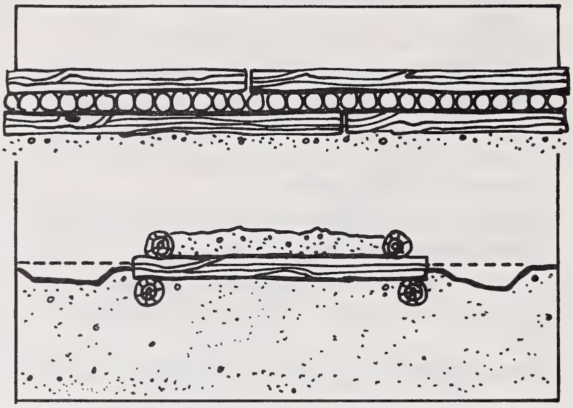
One method of dealing with these areas is removing the top organic layer and laying down fabric filter covered with pit gravel. The fabric allows water to drain, distributes weight, and holds the soil in place.

Puncheons or corduroy may be used through wet areas.

a. **Puncheons** are sawn, treated timber or logs used to elevate the trail above the ground over small wetland areas. They consist of a plank deck set over lengthwise logs (stringers) with enough clearance underneath to ensure proper drainage.

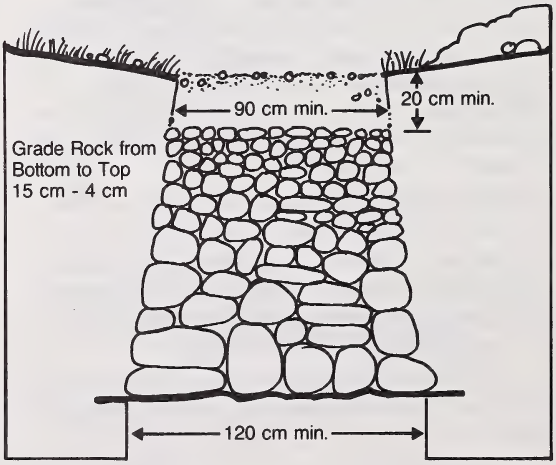


b. **Corduroy** is a technique used to cross marshy areas. Basically, it is the same as puncheon, but less permanent. It is a lengthwise bed of logs covered with flattened soil.

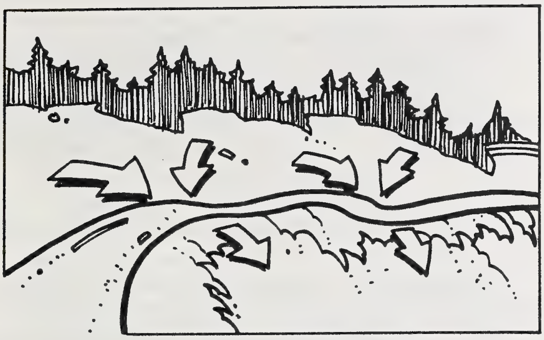


- Areas of water runoff — The runoff areas you encounter may be the result of construction or may be natural. Various methods can be used to deal with this problem.

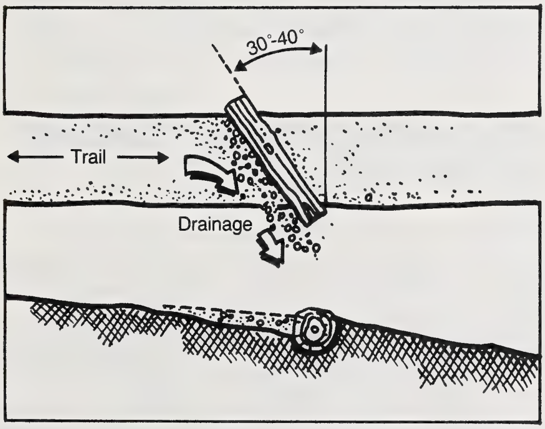
a. **French drains** are effective devices for diverting underground springs. Simply, these are ditches filled with washed rock and covered by topsoil.



b. **Grade dips** are deflections in a trail to divert surface water from the trail. They are used instead of waterbars when a smooth tread surface is required. Place grade dips at frequent intervals to prevent water from building up and eroding the trail.



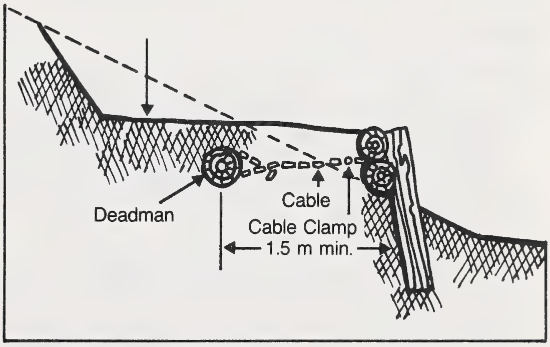
c. **Waterbars** are used to divert surface runoff from very long or very steep slopes where grade dips would not be adequate. Constructed with 3-to-4-centimetre diameter logs or rocks laid at an angle to the flow of water, they should be set above the grade.



d. **Culverts** are used to catch or divert runoff. They can be installed in small streams where a bridge would be too expensive but where fording is too difficult. Use only culverts that are made of galvanized metal and that are large enough to accommodate spring runoff. They should be no smaller than 45 centimetres by 30 centimetres to reduce the chances of plugging and to make cleaning easier; no larger than 125 centimetres by 80 centimetres to reduce the height of the crossing. In every case, make sure the culvert is large enough to allow proper drainage. Consult with an engineer on the options available to you.

- Steep slopes — a retaining wall is used in this case.

Retaining wall should be built on a slope steeper than 45 degrees or a 1:1 angle. As with other structures, use natural materials, such as boulders, railroad ties, and treated timbers for low walls. Where higher walls are required, use timber cribbing, reinforced concrete, or masonry. To prevent moisture buildup, you may need to install weep holes and drain sumps. Consult an engineer if your retaining wall will be higher than 90 centimetres.



Whatever trail construction methods you use, the major concern is protection of the environment through water erosion control and clearing as little of the vegetation as possible.

Base Preparation

In a great number of cases, the actual base of the trail is left as is, after clearing has been done. If this is what you plan to do, the following points should be considered:

- Where soil is susceptible to erosion, dig it out and replace it with firm soil or granular materials.
- Crown your trail to allow for runoff. Crowning is making the trail a bit higher in the middle than on the edges — 14 centimetres for every metre of width.

If you are preparing a multi-use trail, other surfaces may be used. These would include wood chips, gravel, limestone, shale, cement/concrete, soil cement, and asphalt. Prior to placing these materials on your trail, you first must remove the top layer of soil, leaves, and debris. After doing so, a drainage layer of granular

material is laid down and on top of that the trail surface is placed. A further explanation of each of these surfaces is given below:

a. Wood chips

Compact into place to a depth of 75 to 100 millimetres. Trail edging may be needed in some areas to keep the surface in place. No base materials are required, except in areas with soft soil. Unstable soils should be excavated and replaced with firm soil or granular materials such as gravel. On slopes, chips may become slippery when wet.

b. Gravel, limestone, shale

Compact into place to 95 per cent maximum dry density. Depending on soil conditions and the level of use, a base material may not be necessary, especially if the subgrade is free draining. However, on soft subbases, you will require a minimum 7 to 10 centimetre base of compacted pit run gravel. The surface itself should be approximately 5 centimetres deep, then graded and crowned. Trail edging is optional, as these materials are less likely to be scattered.

c. Cement/concrete

While excavating, be sure there is no free-standing water or soft spots. Where you find soft spots, dig out the organic materials or topsoil and replace with firm soil, sand, crushed stone, or gravel fill. A well-compacted subbase of gravel to a depth of 10 to 15 centimetres is recommended.

The minimum thickness of the concrete layer should be 10 centimetres. Once poured, it must be smoothed over to fill in any low spots. If the trail is wider than 1.5 metres, use wire mesh reinforcing. Do not overwork the concrete, however, as this will result in a less durable surface. Let the concrete stand for a week so that it can cure properly.

d. Soil cement

This material consists of 8 to 12 per cent cement, fine-grade sand, and water. The cement is mixed in place with the soil to the depth required. After water is applied, the cement and soil are mixed, compacted, and cured. Note that soil cement must have a proper seal coat over a layer of emulsion to ensure durability. Properly crowned, this tread will shed surface water with little or no erosion.

e. Asphalt

There are basically two types of asphalt available for tread surfacing — hot mix and cold mix. Hot mix is most often used for road surfacing, as it gives a smooth surface; cold mix is most often used for patching. The advantage of using cold mix for trails is that it can be kept soft as long as the solvent is kept in the mixer (hot mix is unworkable once it cools). This allows more time for laying the asphalt; its use is not restricted to areas near mixing plants; and you only need small trucks to bring it in. Like cement, asphalt must be poured over base layers of compacted granular material to prevent frost heaving and settling.

Before your base layer is applied, the subsoil layer will have to be compacted. The amount of compaction will depend on the type of subsoil and surfacing material used. Generally, compacting up to 95 per cent is adequate.
Note: Asphalt trails can be very expensive and should be used for high-density, year-round use. You should also be aware that asphalt ski trails can lose their snow cover in the spring quite quickly, as the sun's heat is absorbed by the black colour.

Constructing Support Facilities and Structures

The exact locations of your facilities have been laid out in the development plan. These may include such things as a warm-up hut, shelter, or lodge, waxing shelter or room, timing hut, washrooms, woodbins, ski racks, gates, benches, signs, picnic tables, and lights. Some of these, such as gates, signs, benches, and tables, may be placed along the trail route.

To acquire information about construction of such facilities and structures, it is advantageous to look at other projects. A good source of information on design for toilets, garbage containers, firewood holders, and signs is the "Park Development" manual included in this Focus Series. Also, the Park Design Series is available from the Outdoor Recreation Facilities Section of Alberta Recreation and Parks. (This includes ideas on such things as signs and parking lots).

One type of facility that should be mentioned is **gates**. They are used effectively only when entry into the trail system from the surrounding terrain is impossible. Otherwise, they will only delay, rather than prevent, entry to determined motorized vehicle users. Offset gates on the trails at fence crossings will allow skiers access while preventing motorized vehicle entry.

Various types of gates are used. A basic gate used to cross fences where track-setting is not required is to place hay bales in a pyramid. If you have decided to groom your trails, don't forget to include a service entry for grooming equipment. Also, if you plan to patrol your trail with snowmobiles, the gates must allow their passage.

Revegetation and Landscaping

Revegetation and landscaping serve two purposes. They help control erosion and they provide a finished product that is pleasing to the eye. Be sure to:

- provide good topsoil for reseeding;
- check with your district agriculturalist on the best type of vegetation to plan to suit your soil and climate (planting methods, seed mix, plant types, and type of stock);
- landscape ground near buildings so it slopes away from the building;
- make use of natural materials where possible (for example, rocks or boulder barriers for vehicle access control);
- remove all wastes;
- revegetate quickly to prevent erosion; and
- mulch, water, and maintain carefully in the first year to ensure successful establishment.

Construction - A Summary

The construction stage of your project can be the most rewarding. It is when you see all the planning and design paperwork actually developing on your site. The construction of your trails will involve the following steps: organizing a work crew, flagging the trail, preparing a final budget, clearing the trail, preparing the base, constructing support facilities and structures, and revegetating and landscaping.

First of all, you must assess your labour needs and organize your work crew. This may include a flagger, supervisor, heavy-equipment operator, and general labourers. These people may be paid or be volunteers. If they are volunteers, keep in mind the points on the care of volunteers mentioned earlier in this manual. If they are paid, terms of reference must be written and a contract signed.

To flag your trail, someone with a knowledge of map and compass work would be helpful. Begin by walking the proposed trail route in both directions — be flexible and make use of the design factors discussed earlier in this manual. Mark the trail with surveyors' tape, either marking the centre or the sides of the trail. As you proceed along the trail route, record, on a form similar to the one in this chapter, the type of work required to construct a trail, along with an approximate cost.

Once you have identified the type and the amount of work required to develop your trail system, a final budget can be calculated. A final budget includes both revenue and expenses. Methods of determining costs would include cost-estimating and bidding by contractors.

Assembling workers, first-aid equipment, and tools, equipment, and machinery is the first step to clearing your trail. As the trail is constructed, grading, drainage, and erosion control should be considered. Methods used to deal with these factors include cut-and-fill techniques, puncheons, corduroy, french drains, culverts, retaining walls, and grade dips.

Various types of base surfaces can be used for your trail. The type you use will be dependant upon your financial situation, the type of soil in the area, and the visual impact of your choice. Once the organic layer of the soil is removed and a drainage material is added, one of the following bases can be used: wood chips, gravel, limestone, shale, concrete, soil cement, or asphalt, or the base can be left in its natural state.

Other facilities needed for your trail system may be built while or after your trail is being constructed. This would include such items as a shelter or lodge, wood bins, trail-head signage, gates, signs, parking area, and benches. Studying other developments and making use of various written resources available to you will give you some ideas for these facilities and structures.

Finally, revegetation and landscaping should be completed. This not only provides erosion control but provides you with a finished project that is pleasing to the eye.

Your facility is built. A great deal of planning, time, effort, and money has gone into the project. Take the time to thank yourself and everyone involved in the project.

MAINTENANCE

Introduction

During the planning stage of this trail development project, maintenance dollars and responsibility should have been reviewed. Now, it is time to make sure all the work you have put into developing a trail system has not been in vain. Maintaining that trail system is an important part of the whole project.

A maintenance budget and schedule will have to be drawn up. The budget would include such things as labour, tools, and track-setting and grooming equipment and repairs. A maintenance schedule outlines the work activities to be completed for preseason and winter maintenance. You will acquire a better idea of the work activities needed as you read through this section.

Trail maintenance can be divided into two categories:

- Fall maintenance — type of work to be completed and tools required to complete job.
- Winter maintenance — snow grooming and track-setting.

Each of these areas will be expanded to give you a more detailed idea of how to maintain a trail system. This information will include everything from basic trail maintenance to the elaborate trail system with a great deal of money and labour available for maintaining it. You must decide on a level of maintenance based on the resources available to you.

Preseason Maintenance

The following tasks will need to be completed before the first snowfall:

- Cleanup — All debris must be removed from the trail. This would include such things as fallen trees and logs.
- Clear new growth — During the growing season, new saplings and branches will have grown up. These will need to be cleared.
- Repair erosion — Check all water drainage routes and structures used to control water flow. If extensive water erosion has damaged the trail, water control structures may have to be repaired or replaced.
- Check structures — Structures will have to be checked for normal wear or vandalism and replaced or repaired where necessary.
- Other — Repair signs, markers, and furniture.

The equipment needed for preseason maintenance includes:

- an axe and a shovel;
- a handsaw — to cut trees close to the ground;
- a brush slasher — cuts saplings up to 6 millimetres in diameter;
- a tree pruner with long handles — cuts branches up to 38 millimetres in diameter; and
- a chain saw — for deadfall, low branches, and large trees.

Preseason maintenance will include the following:

Brushing: Walk the trails, and cut off at the ground, or better, pull out all the small shrubs that pop up every year. Wear thick leather gloves for pulling and watch your backs. The best tool for this is a long-handled **adze** or stout clippers with handles that allow use from an upright standing position. Take the opportunity during this walk to roll loose stones off the trail and chop off roots, etc., that may spring up. If there is long grass on the trail, leave it. It packs down with the first packing and provides a good mat to hold snow.

Boulders and Leveling: A steel bar, shovels, a come-along and a little sweat will end this problem. This is a one time only maintenance job, because once removed they do not come back, so do it now, and do it thoroughly. Erosion will cause most trails on hillsides to gradually slope toward the outside edge. Where this happens, use the adze, picks, and shovels to loosen the excess dirt on the inside trail edge and deposit it to the outside. Usually water has contributed to the problem, so in wet areas trench along the inside or uphill side of the trail grade, and at the bottom of the slope inset a couple of logs across the trail to allow the water to pass under the trail without ruining it.

In general, if you want to get the most out of your trails, get your club together in October and spend a few days each year maintaining and upgrading your system. It's a great way to motivate club members to come out and get together for the approaching season.

Winter Maintenance

Winter trail maintenance involves two types of processes — grooming and track-setting. Grooming is the process of building and smoothing the trail by processing new snow or reprocessing old, compacted snow. Track-setting is a method of placing, with a machine, preset tracks for skiers. Both of these processes, grooming and track-setting, are done with specific types of machinery. Track-setting is very important for trail maintenance and for keeping skiers happy with the trail.

Grooming

Why groom your trails? Grooming packs the snow on your trail and, in turn, allows frost to penetrate the ground beneath the trail to a greater depth. This can extend your ski season further into the spring. Grooming also provides a better quality of snow to track-set.

The sophistication of your grooming program will depend on the following:

- How many skiers use your trail (many skiers will break down the track).
- The time available (especially if you are relying on volunteers).
- The finances available (for equipment, gas, oil, labour, and repairs).
- The standard of trail you want to promote (your skiers may be happy to ski on a snowmobile-packed base).

There are many factors that will affect how you groom. They would include:

- moisture content of snow (dry, damp, or wet);
- snow temperature (heat conduction), radiation, condensation/evaporation;
- surface conditions of the snow (powder, corn, rotten, sun crust, melt-water crust, wind crust, glare ice);
- subsurface snow conditions (sinking or building snow layers); and
- short-term weather forecast (grooming slushy tracks with a cold front coming may cause icy tracks).

1. The Grooming Process

To begin grooming, the trail must be packed as soon as the snow is 10 to 15 centimetres deep. The trail should be packed to its full width. At its simplest, packing can be accomplished by skiing the trail. Steel culverts, weighted with sand or cement, can be pulled behind a snow machine. Commercial compactors using hydraulics are also available.

Most communities will pack with snowmobiles, making four or five passes over the trail. Excessive snowmobile traffic will eventually result in bumps and dips as a result of the up and down motion of the machine.

New, falling snow should be compacted every 10 to 15 centimetres. If you wait too long to pack in areas where snowfall is heavy, your grooming equipment will either get stuck or not really pack as hard as you would like. During periods when there is little snowfall, snow can be pulled into the centre of the trail from the sides with a V-shaped drag.

Make sure your grooming equipment is suited to all possible skiing conditions and available terrain. In good conditions, or on level terrain, nearly any snowmobile can pull grooming and track-setting equipment. However, in rolling country or deep snow, a more powerful machine, preferably with a double tread, is required.

As mentioned earlier, a number of factors will affect your snow-grooming program — the most important is snow.

The following information will provide an introduction to the science of winter snow maintenance. Experience is the best teacher. Talk to people who have maintained trails for a few years. Experiment with your own ideas and your own equipment.

a. Snow is easiest to groom at a **snow** temperature of -7° to -4°C. Colder snow heats up as the surface is compacted and refreezes to form a more solid layer. Remember to pack regularly. Whatever machine you use (snow machine or roller), travel slowly so the machine doesn't roll from side to side, creating an uneven trail surface.

b. Snow that is windblown can either pile up in large drifts or it can blow away leaving the trail bare, icy, or hard-packed.
   - If the drift is deep and blocks the trail, shovel or grade the trail. While shovelling, consider installing snow fencing in this particular area next year.
   - If the trail surface becomes hard-packed or icy, break up the snow with **harrow-like or disc-like devices**. (Local farmers use similar equipment in their fields.) Chain harrows can be made by fastening old tractor tire chains together and dragging them behind a snow machine. Tine harrows, with pointed teeth, can also be used.

c. Snow that has become crusty because of the sun or melting can be groomed in a similar way to windblown snow. If large chunks develop, they will be difficult to break up. A commercial machine called a powder maker is a roller made of open-grid metal. The open cyclinder allows snow to move into the centre. The grid pattern works at the snow to break it down into a loose powder. With ingenuity, you may be able to create a similar home-made device. Otherwise, on very hard-packed or icy areas, the remaining solution is to bring in other snow to cover the trail. If the problem is serious, evaluate rerouting the trail for the next season.

d. Corn snow, melting and then freezing as the temperature changes, should be groomed when the snow has cooled. This condition is more frequent in the spring.

Other grooming techniques include selective trail closures, the half use of wide trails, snow hauling, and snow making.

It is evident that grooming can range from something as simple as **packing with a snowmobile as new fallen snow accumulates** to a program that **packs, conditions, renovates, and repacks your trail base**.

A list of equipment and distributors is included at the end of the manual.

2. Track-setting

A track-setter is a sled-like device that rides on wood or metal runners and is pulled by a snow machine, such as a snowmobile. Why track-set? The track-setter produces a pair of grooves in the snow that give stability to the novice and racer alike. The racer can concentrate on speed, knowing that his or her skis won't slide to the side. The beginner can practise the basic elements of walking and sliding on skis without the worry of having skis disappearing at an angle or crossing in front, causing an abrupt halt to forward motion and a face plant.

The key to good track-setting is to groom or pack the snow properly first, as explained previously.

The art of track-setting involves:

- A knowledge of how skiers ski. For example, on steep uphills and downhills you wouldn't set tracks because the technique the skier may use (herringbone or snowplow) is more easily performed on a level surface.
- A knowledge of your equipment and what can be done with it in a variety of conditions. Trying to use a track-setter when your packed base is too shallow will cause enormous wear and tear on your equipment. The skiers will be skiing on a surface bare of snow.
- A knowledge of the snow conditions and what will happen to the track surface after the machine has gone over the trail. Most skiers and ski trail developers agree that the best knowledge is gained through experience. If you decide you need help, find someone from one of the provincial cross-country ski clubs or provincial government agencies who has had actual experience in track-setting.

Some general guidelines are:

- Set tracks as soon as the trail has been groomed.
- If possible, set your tracks later in the day so the tracks have a chance to set up overnight. They will be harder and firmer.
- Track-setting on warm, wet snow that freezes later will result in icy tracks. During warmer weather when the snow is slightly damp, there is a critical period of two to three hours in the later afternoon where you can track-set without a glaze forming on the track.
- Some commercial track-setters have a renovator attachment that will break up icy sections and mix the snow prior to track-setting.
- Avoid setting new tracks on top of old ones. It is very difficult to keep the track-setter in exactly the same grooves.
- On hillsides, make sure you are setting on a flat surface. If you have to, shovel in snow to make a level surface wide enough to pull your track-setter over. This prevents slipping sideways, down the hill.
- Make sure that the hitch between the snowmobile and the track-setter is secure. If it allows movement in the arm of the track-setter, you will have a sideways movement at the rear of the machine. This will be transferred to the tracks.
- When track-setting down hills followed by corners, set in the total track, then rake or level out the corners. This way your track follows a consistent line from the downhill to the straight section of the trail. The corners are levelled because the skiers will want to perform a skating or stepping technique, and a track is not required.
- Do not track-set steep uphills or downhills. The ski techniques used (herringbone going uphill or snowplow going downhill) require a level surface.
- When setting tracks in a loop system, set the short outside loops first, then the inside perimeter.
- Remove debris or windblown material from the trail before track-setting.
- Keep away from trees along the edge of the trail. Skiers will snag their poles.

- On corners, track to the inside of the turn, then the outside coming out of the turn.
- Operate your equipment at a slow, steady pace.
- Except for races, always track-set with a beginner skier in mind. The above guidelines consider beginners and the skiing techniques they will have to use to negotiate the trail.
- With the introduction of the skating technique, you may want to single track one side of your trail with skating lanes beside.

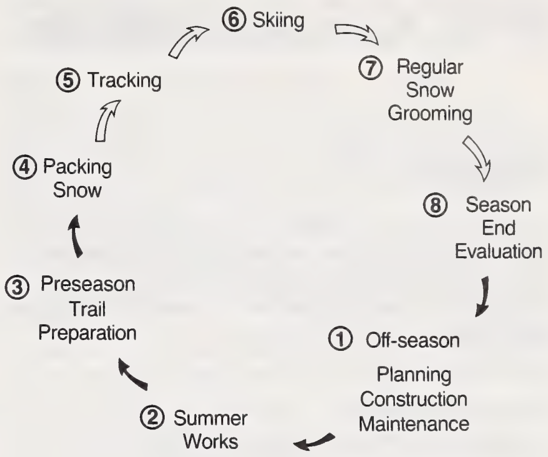
3. Equipment
You can build a sturdy track sled to pull behind a snowmobile for as little as $100 in materials. Or you can spend a few thousand dollars for ready-made, state-of-the-art track-setters. One example of a homemade track-setter is provided at the end of the manual. Also included are addresses of some companies that manufacture snow-grooming and track-setting equipment.

Some things to consider when you are choosing equipment are:

- The availability of labour to do the grooming and track-setting.
- How much money do you have?
- The width of your trails. If you have brushed existing hiking trails and want to use them for cross-country skiing, you may find them too narrow to safely handle equipment.
- The amount and type of snowfall.
- Do you plan to use the trails for racing? If so, track-setting equipment is mandatory.
- The distances to be groomed and track-set. It may be difficult to justify the cost of equipment if you only have short trails.

Maintenance — A Summary

Cross-country ski trail maintenance can be a year-round activity (see following chart), beginning with the off season. During that time, your trail system must be evaluated for repair and maintenance. Having completed an evaluation of the trails, the next step is to set a budget and allocate workers, supplies, and materials. The type of tasks that may be included in the off season would be the clean up of debris, cutting back new growth, repairing erosion, and repairing structures, signs, markers, and furniture.



During the ski season, two types of maintenance techniques are used. These are grooming and track-setting. The process of grooming begins by packing the snow on the trail to allow frost to penetrate the ground beneath the trail to a greater depth. This, in turn, will extend your ski season further into the spring. As the ski season progresses, grooming continues to be an exercise of building and smoothing the trail by processing new snow or reprocessing old, compacted snow. Track-setting is a method of placing, with a machine, preset tracks in the snow.

Various types of machinery are required to groom and track-set ski trails. Depending upon the financial resources available, this machinery can be homemade at a low cost or commercial equipment may be purchased.

The standard of maintenance on your trail system will be determined by the financial and labour resources available to you and the type and skill of skier to whom you are catering.

PROGRAMMING

Introduction

In order for your trail system to be used the way you want, programming may be necessary. Programming means determining what type of activities you want to take place on your trail system. To make this decision, these steps should be followed:

- Set program goals.
- Identify resources.
- Determine the programs you wish to run.
- Promote your programs.
- Run your programs.
- Evaluate.

The Process of Programming

Setting Program Goals

In order to determine program goals, the following questions need to be answered:

- Who do you want to provide programs for (beginner skier, expert skier)?
- What type of programs do you want to run (competitive, recreational)?
- Why do you want to run a program? (Is it to raise money or to get people participating?)

To assist you in answering these questions, a review of your mission statement will be helpful. Secondly, review the resources you have available to meet your needs.

Identifying Resources

A review of the amount of money, labour, and available facilities needs to be done to determine if the programs you want to run are feasible. The following are examples of how resources can affect your program decisions:

- **Money** — If you are going to run learn-to-ski programs for beginner skiers, you may have to buy rental skis. This may end up being an expensive outlay of money. Whatever programs you decide to run, budget preparation is essential.
- **Labour** — Learn-to-ski programs require instructors. Do you have qualified instructors available to teach these classes? You may find that you will have to include leadership training dollars in your programming budget.
- **Facility** — If you are going to run a ski race, do you have the support facilities needed to accommodate judges or feed participants? Your facility must be able to accommodate the programs you choose to run.

Determining Your Program

You now know who you want to accommodate with your programs and what your site can handle. The next step is to match programs to these factors. The following is a list of some program suggestions for cross-country ski areas:

- Formal ski school.
- Jackrabbit program — a program for children, organized through the provincial cross-country ski association.
- Instructional area — programs developed by the Canadian Ski Association and the Canadian Association of Nordic Ski Instructors.
- Handicapped programs.
- Races.
- Citizen's touring race events.
- School instructional programs.
- Social events for service clubs, churches, schools, etc.
- Environmental education and interpretation.
- Ski orienteering.
- Biathalon.

To assist you with other programming ideas, talk to other ski areas and contact Cross Country Alberta (address given in sources section). They will have a good idea of what has worked for them and what trends are most predominant in the skiing community.

Promoting Your Program

Presumably, you've developed your ski trails for the benefit of many skiers and as long as people know that you have trails you will see full use of your trails. The following are some promotional suggestions:

- Sign the roads leading to your trails, especially for people from outside of your community. The provincial department of highways or your local municipal councillors can assist.

- Contact your local newspaper. Offer to write an information piece. Include a map of the trails. Invite a reporter to do a feature article on your development.
- Invite the local media to your trails to go for a ski and sip hot wine afterward.
- Organize an official trail opening ceremony, with the mayor, council, recreation board, media, club members, and all interested citizens invited.
- Promote your area in newsletters of various provincial recreation associations. Cross Country Alberta and its various committees communicate regularly with its member clubs.
- Travel Alberta may include your area in their cross-country ski report on the radio or in promotional material that they produce. Set up a regular contact.
- Host some events, advertise them, and they will make people aware of your trail system. A fun ski, ski challenge to another community, a mass participation ski event, or race can be hosted.

Promotion is done by addressing the needs and interests of the group you identified in your program goals and/or mission statement. You are limited only by your imagination and creativity.

Operating the Program

Whether you have paid staff or volunteers running your structured programs, the following points have to be considered:

- Registration — If it is a program where people pay cash, receipts and a cash float are needed. Someone has to be there to take registrations. Is there going to be a limit on registration?
- Scheduling — What time is best for participation? When is the instructor available?
- Instruction area preparation — If it is a waxing clinic, all the equipment must be assembled. If it is a learn-to-ski program, tracks in the teaching area must be set.
- Administration — Program attendance forms, paying the instructor, and evaluation forms are only some of the details to be considered.
- Liability insurance.
- Emergency services — Consider access to trails, trail-use monitoring, emergency procedures, first-aid training, Canadian Ski Patrol.

Evaluating the Program

Evaluate your trail use each year to determine whether or not you are meeting the skiers' interests, ability, and needs. The skiers identified in your mission statement and/or program goals must be kept in mind when doing the evaluation, and the following questions should be asked:

- Are the people using the trails skiers that you identified in your mission statement and/or program goals?
- If they are, what type of improvements can be made to provide them with a better skiing experience?
- If not, why are you attracting a different group than you identified? What changes are needed to get back to your original intention?
- If you are satisfied with the different type of skier, what improvements can be made to give them a better experience?

Information needed to answer these questions can come largely from the user. It is relatively easy to get such feedback from people in structured programs because they are a captive audience. To get feedback from other users may be more difficult and may need more effort on your part. Suggestion boxes and one-on-one conversations are some suggestions for this type of feedback.

Programming - A Summary

Programming includes making a decision on the type of activities you want to take place on your site. In order to do this, your first step is to determine goals by asking the following questions: Who do you want the program for (e.g., beginner skiers)?; What type of program do you want (e.g., recreational)?; and Why do you want to run a program (e.g., revenue generating)? Reviewing your project statement may help you answer these questions. The various types of and sources of ideas for programs have been presented in this chapter.

Once a decision has been reached on the type of programs you will offer, their promotion is your next step. Promotion is done by addressing the needs and interests of the groups you have identified in your program goals. The various vehicles of promotion would include signage, newspapers, radio, newsletters, and special events.

Now comes the time to operate the programs you have promoted. Items to consider in operating a program include registration (time, receipts, cash float), scheduling (participants, instructor, facility), facility preparation, and administration (attendance forms, bookkeeping).

Each year, your program should be evaluated to determine if you are satisfying the interests, abilities, and needs of the skiers you identified in the program goals and project statement. Get feedback from participants and be as flexible and open to their suggestions as your resources allow.

APPENDIX

Occupiers' Liability Act
Chapter 0 - 3

HER MAJESTY, by and with the advice and consent of the Legislative Assembly of Alberta, enacts as follows:

Definitions

1. In this Act,

(a) "common duty of care" means the duty of care of an occupier of premises of his visitors provided for in section 5;

(b) "entrant as of right" means a person who is empowered or permitted by law to enter premises without the permission of the occupier of those premises;

(c) "occupier" means

(i) a person who is in physical possession of premises, or

(ii) a person who has responsibility for, and control over, the condition of premises, the activities conducted on those premises and the persons allowed to enter those premises,

and for the purposes of this Act, there may be more than one occupier of the same premises;

(d) "premises" includes

(i) staging, scaffolding and similar structures erected on land whether affixed to the land or not,

(ii) poles, standards, pylons and wires used for the purpose of transmission of electric power or communications or transportation of passengers, whether or not they are used in conjunction with the supporting land,

(iii) railway locomotives and railway cars,

(iv) ships, and

(v) trailers used for, or designed for use as, residences, shelters or offices,

but does not include aircraft, motor vehicles or other vehicles or vessels except those mentioned in subclauses (iii) and (iv) or any portable derrick or other equipment or movable things except those mentioned in subclauses (i) and (v);

(e) "visitor" means

(i) an entrant as of right,

(ii) a person who is lawfully present on premises by virtue of an express or implied term of a contract,

(iii) any other person whose presence on premises is lawful, or

(iv) a person whose presence on premises becomes unlawful after his entry on those premises and who is taking reasonable steps to leave those premises.

1973 c79 s1

APPLICATION OF ACT

Effective date

2. This Act applies only in cases where the cause of action arose after January 1, 1974.

1973 c79 s2

Liability of employer

3. This Act does not apply to or affect the liability of an employer in respect of his duties to his employees.

1973 c79 s3

Act inapplicable to highways or private streets

4(1) This Act does not apply to highways (other than leased road allowances)

(a) where a Minister of the Crown in right of Alberta has the administration of, or the management, direction and control of, the highway,

(b) where the Crown in right of Canada has the administration and control of the highway, or

(c) where a municipal corporation has the management, direction and control of the highway.

(2) This Act does not apply to private streets as defined in section 68 of the *Law of Property Act*.

1973 c79 s4

LIABILITY OF OCCUPIER TO VISITORS

Duty of care to visitors

5. An occupier of premises owes a duty to every visitor on his premises to take such care as in all the circumstances of the case is reasonable to see that the visitor will be reasonably safe in using the premises for the purposes for which he is invited or permitted by the occupier

to be there or is permitted by law to be there.

1973 c79 s5

When commons duty of care applies

6. The common duty of care applies in relation to

(a) the condition of the premises,

(b) activities on the premises, and

(c) the conduct of third parties of the premises.

1973 c79 s6

Risks willingly accepted

7. An occupier is not under an obligation to discharge the common duty of care to a visitor in respect of risks willingly accepted by the visitor as his.

1973 c79 s7

Variation of duty of care

8(1) The liability of an occupier under this Act may be extended, restricted, modified or excluded by express agreement or express notice but no restriction, modification or exclusion of that liability is effective unless reasonable steps were taken to bring it to the attention of the visitor.

(2) This section does not apply with respect to a visitor who is an entrant as of right.

1973 c79 s8

Effect of warning

9. A warning, without more, shall not be treated as absolving an occupier from discharging the common duty of care to his visitor unless in all the circumstances the warning is enough to enable the visitor to be reasonably safe.

1973 c79 s9

Contract not to affect strangers

10. When an occupier of premises is bound by a contract to permit strangers to the contract to enter or use the premises, the liability of the occupier under this Act to a stranger to the contract may not be enlarged, restricted or excluded by that contract.

1973 c79 s10

Liability of independent contractor

11(1) An occupier is not liable under this Act when the damage is due to the negligence of an independent contractor engaged by the occupier if

(a) the occupier exercised reasonable care in the selection and supervision of the independent contractor, and

(b) it was reasonable in all the circumstances that the work that the independent contractor was engaged to do should have been undertaken.

(2) Subsection (1) does not operate to abrogate or restrict the liability of an occupier for the negligence of his independent contractor imposed by any other Act.

1973 c79 s11

LIABILITY OF OCCUPIER TO TRESPASSERS

Trespassers

12(1) Subject to subsection (2) and to section 13, an occupier does not owe a duty of care to a trespasser on his premises.

(2) An occupier is liable to a trespasser for damages for death of or injury to the trespasser that results from the occupier's wilful or reckless conduct.

1973 c79 s12

Child trespassers

13(1) When an occupier knows or has reason to know

(a) that a child trespasser is on his premises, and

(b) that the condition of, or activities on, the premises create a danger of death or serious bodily harm to that child,

the occupier owes a duty to that child to take such care as in all the circumstances of the case is reasonable to see that the child will be reasonably safe from that danger.

(2) In determining whether the duty of care under subsection (1) has been discharged consideration shall be given to

(a) the age of the child,

(b) the ability of the child to appreciate the danger, and

(c) the burden on the occupier of eliminating the danger or protecting the child from the danger as compared to the risk of the danger to the child.

(3) For the purposes of subsection (1), the occupier has reason to know that a child trespasser is on his premises if he has knowledge of facts which a reasonable man would infer that a child is present or that the presence of a child is so probable that the occupier should conduct himself on the assumption that a child is present.

1973 c79 s13

GENERAL

Liability re personal property

14(1) Subject to subsections (2) to (4), the liability of an occupier under this Act to a visitor or trespasser extends to destruction or loss of, or damage to, property brought on to the occupier's premises by the visitor or trespasser, as the case may be, whether or not it is owned by the visitor or trespasser or by any other person.

(2) An occupier is not liable under this Act in respect of a loss of or damage to property of any person resulting by reason of the act of a third party.

(3) When a person in an action under this Act claims damages in respect of the destruction or loss of, or damage to, property of which he is the owner and which was brought on to the occupier's premises by some other person either as a visitor or trespasser on those premises, the occupier is entitled to raise any defence to the claim that he would be entitled to raise if the claimant were the visitor or trespasser, as the case may be.

(4) This Act does not apply to or affect any liability of an occupier of premises in respect of personal property arising by virtue of

(a) a contract of carriage,

(b) a bailment, or

(c) the Innkeepers Act.

1973 c79 s14

Application of other acts

15(1) When the occupier does not discharge the common duty of care to a visitor and the visitor suffers damage partly as a result of the fault of the occupier and partly as a result of his own fault, the *Contributor Negligence Act* applies.

(2) When an occupier is liable under section 12(2) or 13, and the trespasser or child trespasser, as the case may be, suffers damage partly as a result of the fault of the occupier and partly as a result of his own fault, the *Contributor Negligence Act* applies.

(3) When in an action brought under this Act 2 or more occupiers of the same premises are each found to be at fault, the *Tort-Feasors Act* applies.

1973 c79 s15

Crown bound

16. The Crown in right of Alberta is bound by this Act.

1973 c79 s16

Application For Use Of Public Lands

MAKING APPLICATION FOR
RECREATIONAL USE OF PUBLIC LANDS

Alberta
ENERGY AND
NATURAL RESOURCES
Public Lands Division

Public lands, under the jurisdiction of Alberta Energy and Natural Resources, can be made available for recreational purposes to individuals, societies, associations and companies. Recreational purposes are defined to be any commercial or non-commercial use of public lands for the purpose of providing leisure activity for individuals or groups. Hunting and fishing camps, river tours, trail rides, summer camps, campsites, gun ranges, golf courses, sports grounds, ski trails and picnic areas are examples of recreational uses of public lands. Applications for leases for private recreational cottages are normally restricted to lots within established recreational subdivisions.

In order to occupy public lands for recreational purposes, one must make application and receive written authority from the Public Lands Division of Alberta Energy and Natural Resources.

A. TYPE OF DISPOSITIONS

Four different types of application may be considered.

1. **Recreational Lease**. This type of disposition is available to municipalities, agricultural societies constituted under the laws of the Province, or societies incorporated under the Societies Act. Recreational Leases are normally issued for a maximum of 20 acres and a term of 21 years, renewable for a further term of 21 years at the discretion of the Associate Minister of Public Lands and Wildlife. Nominal charges are assessed for Recreational Leases. Upon approval of the lease, the lessee must provide a survey, or meters and bounds description of the lease area.
2. **Miscellaneous Lease**. This type of disposition is available to Canadian citizens over the age of majority, and to registered companies. The term of the lease is at the discretion of the Associate Minister of Public Lands and Wildlife, but will not exceed 25 years, renewable at the discretion of the Associate Minister. Yearly rental is assessed as a percentage of the appraised value of the land. The lessee must provide a survey or meters and bounds description of the lease area.
3. **Miscellaneous Permit**. This type of disposition is available to Canadian citizens over the age of majority, and to registered companies. Permits are issued for up to one year, but may be renewed at the discretion of the Associate Minister. Yearly rental is assessed as a percentage of the appraised value of the land. No survey or meters and bound description of the permit area is required.
4. **Licence of Occupation**. This type of disposition is available to municipalities, registered societies, Canadian citizens over the age of majority and to registered companies. A Licence of Occupation is normally issued for the purpose of constructing roadways and trails on public lands. The term of the licence is granted at the discretion of the Associate Minister. No survey or meters or bounds description is required.

NOTE: Payment of taxes on dispositions is the responsibility of the disposition holder.

B. COMPLETING THE APPLICATION

Application for Recreational Leases, Miscellaneous Leases and Miscellaneous Permits must be made on application form LS 1/79. Applications for Licences of Occupation must be made on application forms LS 12/82. These forms are available from local Public Lands or Alberta Forest Service offices, or from the Public Lands Division in Edmonton.

For an application to be processed, the applicant must ensure that the application form is complete and accurate. The following must appear on the form.

1. **Purpose of Application**. The type of disposition applied for must be checked off on the application form and the total acreage applied for should be stated.
2. **Applicant's Name, Address and Telephone Number**. If a registered society or company, the complete name should appear along with the name and address of a contact person or agent. In the case of a registered society, a copy of the Certificate of Registration should accompany the application.
3. **Lands Applied For**. The legal description of the area applied for must be clear and accurate. Township, range, meridian, quarter-section and legal sub-division are to be provided.

   A survey or sketch plan must accompany the application with the area applied for outlined in red. This area plan should be to scale and must indicate section lines and the actual dimensions of the area.

The plan also should show access to the area applied for, existing roads, waterbodies and improvements in proximity to the site.

A detailed and accurate plan can reduce the time required to process an application and will help avoid lengthy delays caused when further plans and information must be requested.

In addition to the area plan, a site plan may be required if extensive development of the area is proposed. This site plan should be to scale and must show the location and dimensions of any planned building, parking lots, trails, boat launches, corrals, picnic areas, or other facilities, to be constructed. Where the site is in proximity to a waterbody, the location and distance of planned facilities to that waterbody should also be shown.

NOTE: If roads must be built to gain access to the area applied for, a Licence of Occupation may be required.

4. **Proposed Use**. When submitting an application it is important that details of the proposed use be provided. The application must indicate how long the area will be required, what the area will be used for, what developments are intended on the land, what improvements currently exist and who owns them.

5. **Personal Data**. When applicable, this portion of the application form should indicate whether the applicant has reached the age of majority, whether he or she is a Canadian citizen and whether he or she is employed by the Government of Alberta.

C. WRITTEN SUBMISSION

A written submission may be required in addition to form and plans. The amount of written detail to be provided will depend on the extent of the proposed development.

When the proposal covers an area of more than 20 acres, or is intended for large-scale development or heavy use, more detail on the proposal is required. Detailed information as to the nature of the proposal, specifics on the activities to take place on the site and planned periods of use and number of users, should be included. A development schedule should be included, outlining when construction will begin, estimated time until completion and any plans for future development. When the scale of cost of the proposed development is large, the applicant should provide information demonstrating financial capability to proceed with the proposal.

In addition, the applicant may be required to provide justification for the proposal. The Department will be considering such questions as: Are there existing facilities in the area that could serve the same purpose? Is the proposal the best use that can be made of this land? Is the proposal in the best interests of nearby communities? What segment of the community will this proposal benefit?

These kinds of questions will be considered when the application is being evaluated and any information that can be provided by the applicant will assist the Department in making a decision.

D. ENVIRONMENTAL IMPACT ASSESSMENT

The applicant should be aware that in the event the application is for a major resort and/or recreational facility, the Minister of Environment may require the applicant to submit an Environmental Impact Assessment Report.

E. SUBMITTING THE APPLICATION

Applications should be submitted to:

Special Land Dispositions Section
Public Lands Division
Alberta Energy and Natural Resources
9915 - 108th Street
Edmonton, Alberta
T5K 2C9

The length of the review process varies with each application. Two or more months is not uncommon. Major proposals may involve evaluation by a number of Government agencies and departments. If application is made for a commercial development, the area may be publicly advertised. Applications should be submitted well in advance of any proposed construction.

Applications are reviewed individually. A proposal may not be authorized if it is determined that more appropriate use can be made of the land. It must be remembered that public land suitable for recreational development is a limited resource and careful consideration must be given to its development.

If you require any assistance in completing the application or supporting information, or have any questions, please contact the Special Land Dispositions Section at the above address or phone 427-3570.

Applicants are reminded that an application does not give the applicant any rights or priority to the land for which he has applied. Applications may be cancelled by the Department because the land applied for is not suitable due to environmental factors or other reasons.

Sources

For information on becoming incorporated as a nonprofit organization contact:

Alberta Consumer and Corporate Affairs
Corporate Registry
10365 - 97 Street
Edmonton, Alberta
T5J 3W7
Phone: 427-0430

For grants information:

Alberta Municipal Assistance Program (published annually)

available free from:

Alberta Municipal Affairs
Duplicating Services
4th Floor, 9925 - 107 Street
Edmonton, Alberta
T5K 2H9
Phone: 429-4880

Alberta Recreation, Parks and Wildlife Foundation
7th Floor, 10045 - 111 Street
Edmonton, Alberta
Phone: 482-6467

Alberta Career Development
Park Square
10001 Bellamy Hill
Edmonton, Alberta
T5J 3W5
Phone: 422-1184 or Zenith 22078

Canada Manpower
(contact your nearest regional office)

For planning and program assistance:

Canadian Association of Nordic
Ski Instructors (CANSI)
1220 Sheppard Avenue E.
Willowdale, Ontario
M2K 2X1
Phone: (416) 495-4210

Cross Country Alberta
14904 - 121A Avenue
Edmonton, Alberta
T5V 1A3
Phone: 459-4619

Canadian Ski Patrol System-Nordic
9713 - 76 Avenue
Edmonton, Alberta
T5K 2K8
Phone: 423-7333

Alberta Biathalon Association
12th Floor, 101 - 6 Avenue, S.W.
Calgary, Alberta
T2P 3P4
Phone: 297-2503

Alberta Jumping/Nordic Combined Association
14904 - 121A Avenue
Edmonton, Alberta
T5V 1A3
Phone: 459-4619

Canadian Ski Association (Alberta Division)
Percy Page Annex
14904 - 121A Avenue
Edmonton, Alberta
T5V 1A3
Phone: 452-3763

Alberta Orienteering Association
Room 104A, 429 - 14 Street, N.W.
Calgary, Alberta
T2N 2A3
Phone: 270-7557

For buying maps and air photos:

Maps Alberta
Bureau of Surveying and Mapping
Alberta Forestry
2nd Floor, North Tower
Petroleum Plaza
9945 - 108 Street
Edmonton, Alberta
T5K 2G6
Phone: 427-7417

or

Room 804
J.J. Bowlen Building
620 - 7 Avenue, S.W.
Calgary, Alberta
T2P 0V8
Phone: 297-7389

For information on land titles, leases, and access:

Alberta Energy and Natural Resources
Land Dispositions Branch
9915 - 108 Street
Edmonton, Alberta
T5K 2C9
Phone: 427-3590
(for information on public lands)

Alberta Environment
Oxbridge Place
9820 - 106 Street
Edmonton, Alberta
T5K 2J6
Phone: 427-2739
(for information dealing with water crossings)

Alberta Transportation and Utilities
2nd Floor, Twin Atria
4999 - 98 Avenue
Edmonton, Alberta
T6B 2X3
Phone: 427-2731
(for information on road and utility right-of-ways)

For information on cultural sites:

Alberta Culture
Historical Resources
12th Floor, CN Tower
10004 - 104 Avenue
Edmonton, Alberta
Phone: 427-2565

For information on workers' compensation:

Workers' Compensation Board
9912 - 107 Street
Edmonton, Alberta
Phone: 420-0082

For information on climatic conditions:

Environment Canada
Atmospheric Environment Services
Regional Headquarters
Twin Atria
4999 - 98 Avenue
Edmonton, Alberta
T6B 2X3
Phone: 420-3143

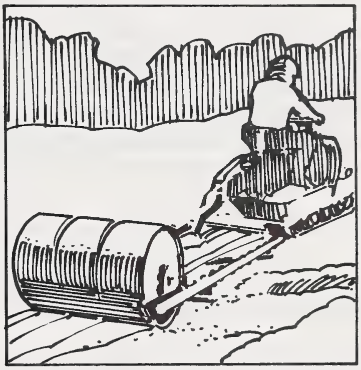
For information on working with consultants:

"Selecting and Working with Consultants"
Alberta Recreation and Parks
9th Floor, Standard Life Centre
10405 Jasper Avenue
Edmonton, Alberta
T5J 3N4
Phone: 427-4471

Equipment

Note: The following pages on equipment are given as information only and do not imply recommendation or approval by Alberta Recreation and Parks.

Homemade Groomers



With few exceptions, snowmobile trail grooming projects across the United States and Canada have been carried out by local snowmobile clubs.

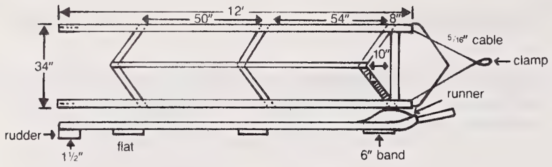
The strain on budgets often means clubs are faced with a choice: either maintain trails using resources at your disposal, or provide sub-para trails. At worst, do nothing about the trails.

Fortunately for the rest of snowmobiling public, dozens of active and progressive snowmobile clubs have accepted the trail grooming challenge. With volunteer manpower, a little imagination, donations of whatever materials they can find, these clubs have been creating a variety of "homemade" trail grooming drags.

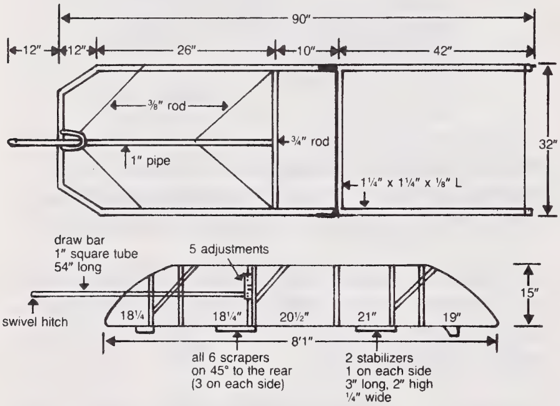
Many of the drags you'll see in this section are designed for use behind family snowmobiles or Alpine-type utility vehicles. A few were specially made for larger grooming tractors. Almost all of them can be scaled to fit your trail situation by enlarging or decreasing the dimensions.

Each "homemade" drag employs materials readily available to anyone—angle iron, discarded oil drums, steel pipe or rod, wooden 2x4's, etc. Scrap material can work as well as brand-new, if you can find it. All it takes is the willingness to get involved.

Here are some ideas offered by your fellow snowmobilers.



Darrell Swearingen of Rolling Hills Snowmobile Club, Spooner, Wis., uses this 12-foot long by 34-inch wide steel pipe-and-angle iron drag behind a Polaris 300cc Mustang. Main side supports of 1¼-inch pipe can also be made with 2x4s. A brace piece welded to the angle iron cutting blades provides extra strength. Towed by cable, the drag has a flexible front bumper to prevent collision with the snowmobile track.

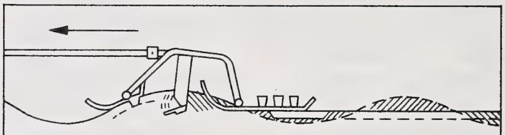


The Southern Vermont Snow-Goers have developed a drag measuring just over eight feet long by 29½ inches wide, built with rigid conduit pipe framing and quarter-inch flat stock steel scraper blades. This drag, with adjustable tongue for deeper or shallower cut, is designed to cut moguls and thoroughly work up the snow before the rear grading plate smooths the trail. Small stabilizers keep the drag in line as it is being pulled. The unit also has a swivel hitch and flips over for easy towing.

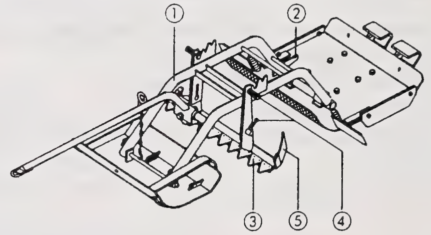
Source: Darrell Swearingen, Rolling Hills Snowmobile Club, Spooner, Wisconsin.

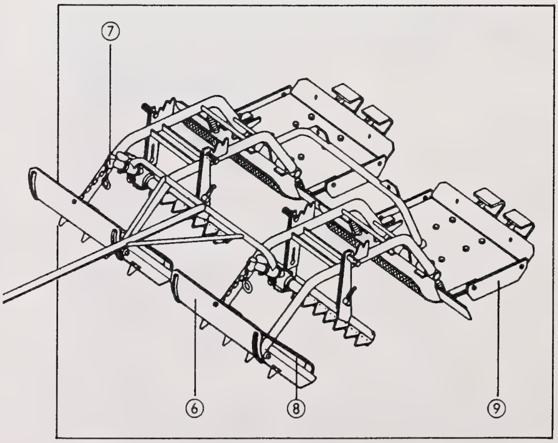
Commercial Groomers

Renovator-Smoothing Equipment (Patent)
Each Bachler track-setter can be improved in its function with the Renovation (1). In one movement, the Renovator is easily attached with a connecting pin (2) to the track-setter. The vertical knives (3) will loosen and level out frozen, wornout and moguled tracks (see illustrated). The icy, hard surface is being cut and mixed with the lower layers of snow. Moguls are leveled and hollows filled up. All this happens in one working operation. The desired depth (4) of the track can be individually adjusted. Guide bars (5) can be mounted on both sides of the Renovator. These guide bars carry the snow inwards filling in old tracks. This helps to form a solid track, even if the depth of snow is very low. If a rough and snowless spot has to be crossed, the smoothing sledge (6) can be lifted by hand and hitched to the draw bar (7). This saves wear and tear on the renovator knives. The Renovator will now slide on the two runners (8) safely and without damage. The lateral leading pieces (9) are used as side runners and protect the main track elements. By releasing the renovator, the smoothing sledge



Function of the Bächler Tracksetter with Renovator. Levelling, loosening and tracksetting in one operation.





automatically returns to the right working position. The Renovator is available as single, double or multiple configurations. Single Weight: 90 lbs (41 kg).

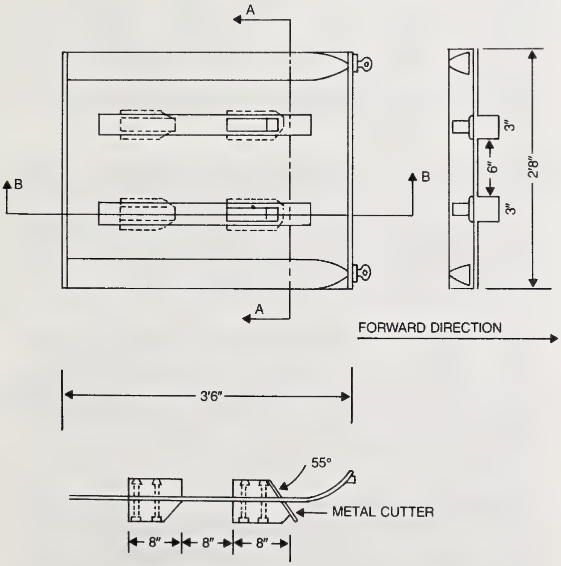
Source: Jaeger Ski Enterprises Limited, Vancouver, British Columbia.

Homemade Track-Setters

Track-setting Sled
This sled was designed by Sven Johannsen, Biathalon Ski Coach, for use at the Biathalon Training Center in Anchorage, Alaska where they have to contend with a heavy snowfall throughout their long winter. The idea of the sled is to aid in the setting of cross-country tracks for training with a minimum of effort and time taken.

Following will be building instructions gathered from my own personal experience in the construction of the above sled. Total cost to build the sled was about $10.00.

Materials: 36″ x 32″ x ¾″ sheet of plywood, one pair of old skis, some hard wood blocks, metal plates, 8-6″ x ¼″ stove bolts, 2 doz-1½″ x ¼″ and 32 nuts and washers, Elmers glue and 2 rings and hangers.



STEP 1 - To bend plywood requires the relieving by saw to ½″ in depth every ½″ for 6-8″ from your chosen front of sled.

STEP 2 - Cut skis to desired length, use 1½″ x ¼″ bolts to attach skis to plywood. To aid the bending of the plywood, brace front of sled off the ground and weight the sled. Also at this time place glue in the slots to aid the holding of the bend. Give 24 hours to dry.

STEP 3 - Cut blocks to desired shape and size. Find the center line of your sled. Three inches each side of this line will be the center line of the runners (or blocks). Use 6″ x ¼″ stove bolts to attach runners and above holding blocks to the sled.

STEP 4 - Make slots in sled to allow metal cutters (plates) to be adjusted and slide through.

STEP 5 - Paint sled desired colour (2 or 3 coats).

STEP 6 - Attach rings and hangers for pulling.

Now that you have your sled built it is time for some experimental testing on your part.

The track setter has to be pulled by a skidoo, no preference necessary, and most usually has to be weighted depending on the consistency of the snow. The best methods found by myself for weighting is the use of sand or chains in a grain bag. This makes it easy to adjust the weight to different areas of the sled or change the desired amount of weight quite easily. Also this method requires no straps for holding the weight in place.

The track-setter works best at slow to moderate speeds. Steep hills present a problem, but can be circumvented by running them in reverse. Come down over steep hills if possible.

One to two skiers should follow the sled to smooth up the track.

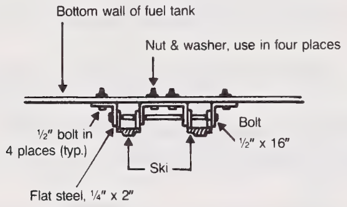
If sled is built to specifications and utilized in control I'm sure that it can aid all high school and college coaches in the easy preparation of training courses. Also all chiefs of course should find it beneficial in making their jobs easier when it comes to laying in the track for a big race.

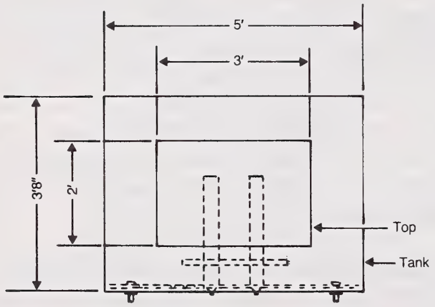
Trail Blazer

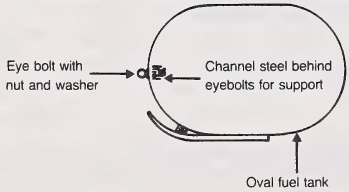
Blazing a trail is never easy, but blazing it through newfallen snow is even tougher. That's why one park employee's idea for a trail blazer made of recycled materials makes good sense.

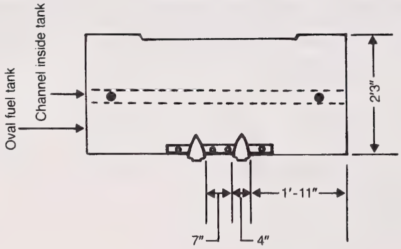
It can be constructed from a recycled 1,000-litre oval fuel tank and used snowmobile skis. The 1.5-metre-wide fuel tank packs the snow, and the skis cut in to create ski trails.

The skis are fastened to the bottom of the tank, with the back of the skis left loose to follow the terrain. A 60-centimetre by 90-centimetre hole in the top of the tank allows weight to be added in deeper snow if necessary. The trail blazer is pulled from 1.25-centimetre eyebolts attached 10-centimetres from each side. A piece of 1.5-centimetre manila rope is spliced to snap hooks for quick hook-up.







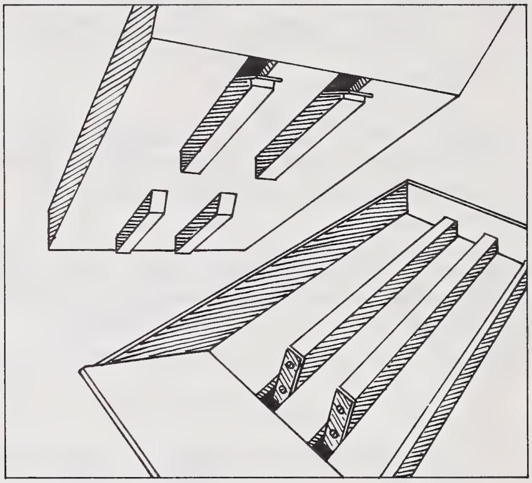


Be Right At Home Making Tracks

by Frank Farwell

(*Nordic World*/February 1979)

Deciding between making your own tracks for cross-country skiing and going to a ski touring center is much like the choice between buying a ready-to-sail boat or building one yourself with the raw materials and a set of plans. Siding with the store-bought product will cost you more, will be ready to go and require no assembly. The do-it-yourself choice costs far less but requires hours of patience and time, plus a familiarity with building.



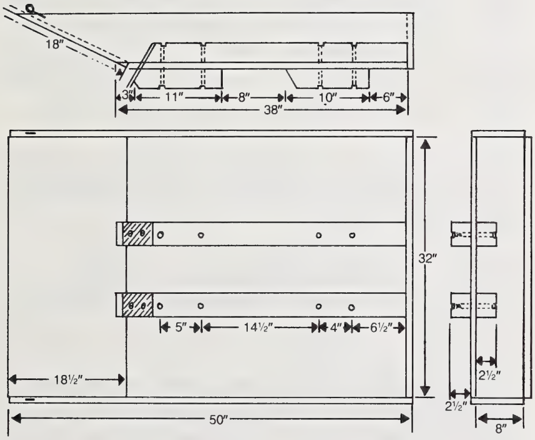
Sketch shows positioning of track-cutting blocks (top) and tub portion of sled (bottom).

Happily for the cross-country skier, the choice between using other peoples' prepared tracks or making your own entails a considerably smaller range of complications. It's quite easy to set your own professional-style cross-country tracks.

While cross-country skiing can be enjoyed wherever there is snow in your backyard, at local golf courses or parks and state and national forests — most people agree that skiing in fast, machine-prepared tracks offers the most fun.

Machine-prepared trails are 70-millimeter-wide double tracks that are cut, smoothed and molded over a packed base. They are set by a track-setter, a sled-style device that rides on wood or metal runners and is pulled by a snowmobile or similar tread-powered machine. Cross-country racers using ultra light, thin skis compete on a machine-set track at speeds often up to 25 mph on downhill sections of the course. Good tracks remove irregularities in the course, much like a hockey rink is resurfaced (zambonied) between periods.

The advantages of such a manicured track are also a big help to beginners. The even contour of the trail layout aids the learning process. Just as rough, gutted ice is a difficult surface on which to learn skating, an ungrooved trail is a less-than-ideal place for the beginning nordic skier. Track-setters produce a pair of grooves that give stability to the skiing motion for novices and racers alike. The racer can concentrate on speed via a hard, efficient kick, knowing that his skis won't slide to the side. The beginner, safe in the security of a grooved-trail net work, can practice the fundamental motion of walking and sliding on skis without the worry of having his skis vanish from underneath him.



Track-sled assembly diagram (in inches)

Light, new snow or soft cover snow in the backcountry — far from machine-groomed trails — is a delight to ski. In the right conditions, even the beginner can carve wide snowplow turns downhill. No one will contest that those moments are some of the finest in the cross-country experience — an experience when such conditions give an unlimited range of travel.

Unfortunately, these soft snow conditions are rare, and have been especially so with the fluctuating weather moods of the past few seasons. When snow hardens, it's difficult — and often impossible — to set out for a tour in your local woods. The snow may be crusty or icy, and it will be slow, unenjoyable going — a far cry from touring in optimal conditions.

That's where track-setting comes in. Machine-groomed trails allow for skiing in conditions that would otherwise be unenjoyable. On a cold morning after the previous day's mushy snow has refrozen hard, a track sled and snowmobile combination will pack out a trail and then cut a double groove. A track sled also will "farm up" unmetamorphised snow just underneath the surface and recycle it to the top layer, much like the action of a roto-tiller in a garden. Result: Even on an icy, miserable day, a machine-grooming setup can provide skiable trails.

That brings us to the subject of touring centers and the possibility of making your own tracks. On one of those miserable days you either don't ski, or you head to a touring center where, for a modest trail fee (usually $1-$4), you can ski all day on carefully prepared tracks. There are a multitude of cross-country centers in northern states, and many — besides offering instruction, rentals and in some cases meals and lodging — are worth the trip just to experience the Scandinavian-style atmosphere and ambience.

At the same time, many touring centers offer little more than a bare-bones ski shop and a hastily-prepared trail system. That's where the idea of owning your own track-setting equipment comes in. You can build a sturdy wooden track-sled to pull behind a snowmobile for as little as $30 in materials. Or for as much as $900 (for a track sled and a gyro groomer from Woodcrest, Inc., Bradford, N.H.), you can buy the same type of trail-grooming equipment that will be setting tracks for the next Olympics at Lake Placid.

At either end of the spectrum, making your own trails for all-condition skiing is a real possibility, — if you're willing to invest the time. If you are, and know another enthusiastic skier or two, you easily can convert a large backyard or local park or golf course into your own touring area. You'll have the fun of learning the track-setting process, and you won't have to drive to a touring center.

Although laying out perfect trails is a complex forestry science, you can simplify the problem by selecting unused lumber roads, or areas that are already cleared, after, of course, gaining the owner's permission to set tracks there. Your sales pitch should be this: In return for leaving the owner a superb place to ski in all conditions, you will be allowed to use the tracks. Most reasonable landowners will answer affirmatively if they are interested in recreation. With this approval, you are on your way.

In your second season you may well want to extend the trail network. But in the beginning, stick with lumber roads and meadows. That way you'll minimize pre-snow time spent clearing brush. After some experience you'll probably see where you can add the most interesting extra loops and downhills.

A homemade sled, such as the one described here, will lay a superb track at low speeds, and is all a do-it-yourself touring center will need. If you pull the sled at speeds faster than 8-10 mph, the track will fill in noticeably; in this case it's best to have a skier touring behind to smooth things out. "Store-bought" track setters leave an ideal track at nearly any speed.

When starting out, drive over the trails with just the snow machine. This packs the snow to a good base. Then hook up the sled and drive the same route. Anticipate the power you'll need on uphills, and don't speed on downhill turns. When possible, use a shovel to bank sharp corners on downhills before you set the tracks.

In good conditions, or on level terrain, nearly any snowmobile can pull a tracksled efficiently. But in rolling country or in deep snow, you'll need a powerful machine, preferably of the double-tread variety. Some touring centers use a full scale snowcat, and haul a tandem of track setters, but that runs into money which, most likely, only a school, municipality or large ski club can afford. For that reason, such a plan may be a few years down the road for most.

With a little poking around, you can usually buy a used snow machine for less than $400, which friends or ski club members might be willing to share. Then spend $50 for a top mechanic to tune it to fighting pitch, ready to haul a homemade sled. When you finish the sled, take an extra few hours and smother the bottom with two coats of fiberglass. Then paint on your hot-shot new ski-club logo. The fiberglass will save you time and repairs in the long run, and a few hundred kilometers down the trail, your rock-scarred tracksled will thank you from the bottom of its runners.

Materials Needed to Build Your Own

Materials: One sheet of plywood measuring 36" x 32" x ¾" (base); two pieces of plywood measuring 50" x 6" x ¾" (sides); one piece plywood measuring 32" x 6" x ¾" (back); one piece plywood measuring 32" x 18" x 32" (front); two hardwood blocks measuring 33" x 2½" x 3"; two hardwood blocks measuring 11" x 2½" x 3" (front track cutters): eight 6" x ¼" bolts; two plates of very hard metal measuring 6" x 3" x ½" or ¼"; four flush-mounted woodscrews; several 1½" x ¼" woodscrews; glue or epoxy; two heavy-metal ring bolts with nuts.

Measure and draw a center line on the base (36" x 32" x ¾") sheet of plywood. The inside edge of the track-cutting blocks must be three inches to either side of the center line, near the front edge of the base piece of plywood. At that point, cut two 3" x 3" holes (see diagram).

Holes must be drilled in hardwood blocks and base to mount cutting blocks to base with the 6" x ¼" bolts. Countersink the nuts and bolts, and fill in with wood-filler before covering with epoxy. Long blocks go on top of base, the 11" x 2½" x 3" (front) and 10" x 2½" x 3" (back) blocks on bottom. Lower blocks must be eight inches apart fore and aft, and six inches apart side by side.

Attach metal plates with wood screws to the front cutting blocks, which should be planed to a 55-degree angle, slanted forward, to give scooping effect while cutting groove in snow.

This also forces the snow through the front portion of the 3" x 3" holes onto the top, tub portion of the sled. Block widths can be varied according to the type of skis to be used more frequently in your tracks; racing skis take a narrower track than touring skis, but favor being on the wide side for the sake of beginners.

Side, front and back pieces of plywood can be glued to the base, but attaching with screws and bolts will strengthen the sled.

Fiberglass the bottom with at least one generous coat. Paint sled with at least two coats of water-resistant covering.

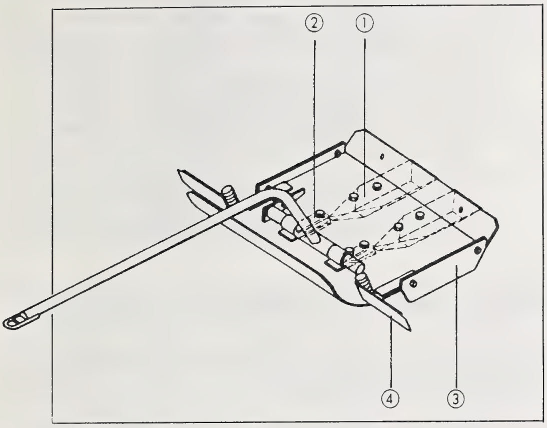
When assembled, these materials will form a scow-shaped tub with a sloped front edge that will ride over rough portions of snow, like the bow of a river barge. The metal cutting plates are unnecessary in new, soft snow, but are essential to set tracks in old, refrozen snow where they will rip through the rigid upper crust and cut through to better, preserved snow underneath. This snow will be "farmed" and forced up through the hole in the sled bottom (in front of each of the cutter edges, and measuring 3" x 3"), and pile up on top of the sled, adding weight and aiding in compression.

Wood strips can be added to the sides of the bottom blocks to help make wider tracks that are suitable for all touring skis. Ideally, the blocks on the sled above should be modified to leave a beveled track, wider at the top than at the bottom to allow for free movement of a boot's overhang on the ski. This avoids the scraping irritation of the boot leather, which can slow the skier in rough snow conditions.

Total cost of this homemade model: approximately $30 in parts, plus 10 hours labor. This model is adapted from a design developed by the late Sven Johannsen, former coach of the US Army biathlon team at Anchorage, Alaska.

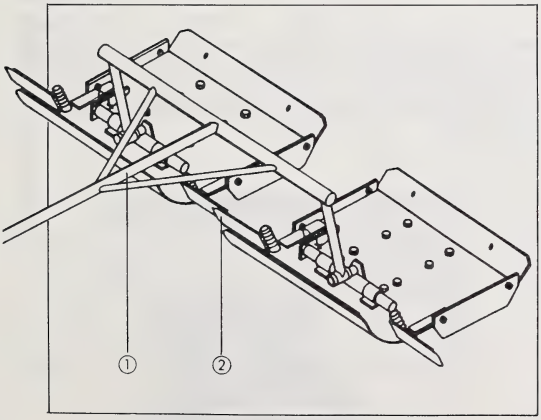
Commercial Track-Setters

Single-Tracksetter Type Standard LLS/76



This is low-priced standard equipment for the systematic construction of a track system and produced in solid steel. The "main track elements" are (1) of cast iron and bolted to the track sledge with the distance between the tracks adjustable. The asymmetric profile pre-cutter (2) made of manganese steel preserves the main track element and increases the compression of the track wall, in order to prolong the service life of the track. The lateral leading piece (3) guarantees an absolute proper track in all snow conditions. The edge finisher (4) grooms the pole plant area beside the tracks. Weighs: 88 lbs. (40 kg).

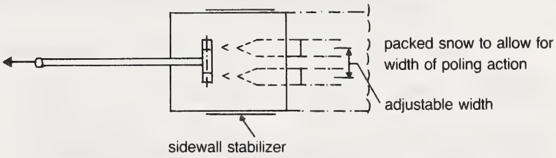
Double-Tracksetter Type Standard LLS/76-D



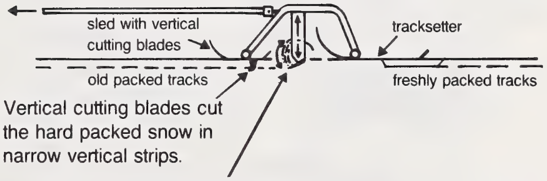
Wherever possible a double track-setter should be used. Double tracks allow every cross-country skier to pass or walk next to each other. Two single track-setters are combined with a double draw bar (1) thereby constructing a very efficient double track-setter. The draw bar is equipped with double hinge fittings, allowing each track-setter to adjust to the ground individually. The track-setters run a parallel course, and between the two track-setters the edge finishes (2) overlap, so that no disturbing snow ridge can build up. Weight: 213 lbs. (97 kg) (without additional weights). A snow vehicle is necessary as drawing machine for the double track-setter.

Commercial Double Track-Setting — Bachler The Classical Way of Track-Setting

Source: Jaeger Ski Enterprises Ltd., Vancouver, B.C.

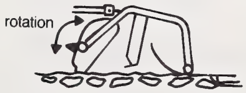


Tracksetter for setting tracks in new, soft or untouched snow. Old used tracks and hard packed snow cannot be done with this setter alone.



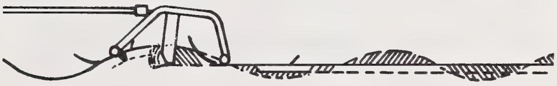
Vertical cutting blades cut the hard packed snow in narrow vertical strips.

Horizontal cutting blades (adjustable height and cutting angle) cut through old packed snow horizontally below the old packed tracks (already cut vertically), chopping and mixing this snow with the base snow to prepare for the tracksetter following close behind.

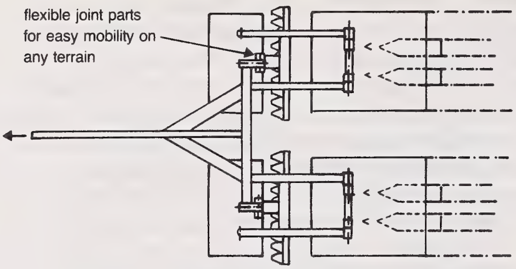


When crossing bare roads, the sled with the vertical cutting blades can be lifted and locked into place.

Experiments carried out in the construction of the sled have produced a lightweight yet stable apparatus. For extremely hard packed snow, a sandbag can be used to further weight the sled.



Terrain with bumps and hollows can be leveled out in one operation.

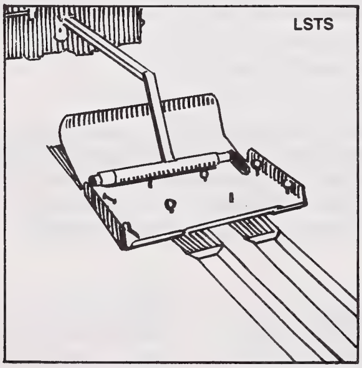


Two single tracksetters LLS/78 or tracksetters with renovators LLS/78-PL combi can be pulled at the same time by using a double bar thus forming two pairs of consistently parallel tracks.

Single Tracksetter LSTS

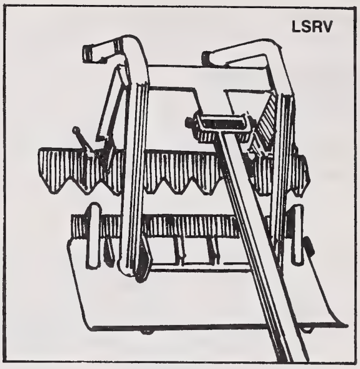
The width of the track can easily be changed by adjusting the eye bolts on the equipment. Adjustable side guides will insure a stable direction in any kind of terrain at high speed. It can also be attached to the renovator.

For the limited budget - a high return.
Weight approx. 43 kg (95 lb)



With the Renovator PL we have a totally new device on the world market. It serves to renew uneven and icy tracks with remarkable efficiency. With the diagonal knives in conjunction with the forward knives, snow and ice are cut into small parts. By specially fitted horizontal knives, the particles are intermixed with soft snow and flattened to the width of the track. Each knife is independently mounted and easy to replace. Both machines work effortlessly in unison. Old tracks can be quickly renewed in this manner. It is only used in front of the LSTS and can be connected to the tracksetter with a bar and very little effort.

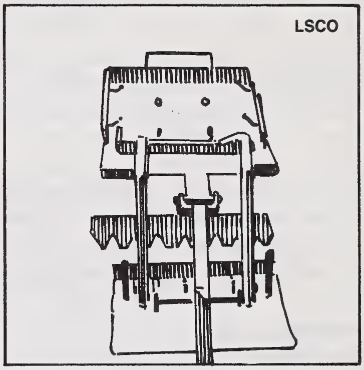
Weight approx. 43 kg (95 lb)



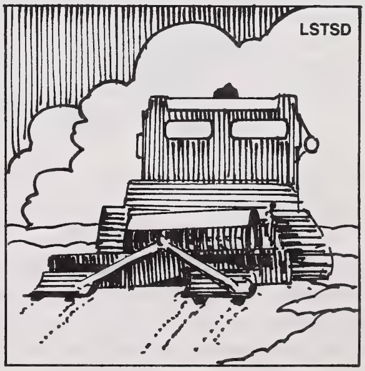
Single Tracksetter with Renovator Combined LSCO

This equipment is used in combination with the single tracksetter and the Renovator.

Weight approx. 86 kg (190 lb)



Two single tracksetters LSTS or two tracksetters with renovators (LSCO) can be connected by a double bar to form two pairs of parallel tracks equally spaced one metre apart.



Wind Chill Factors and Tables

Source: Atmospheric Environment Service,
Environment Canada.

Nearly everyone is aware of how much colder it feels outdoors on a windy day as compared to when there is no wind, particularly in the winter. This apparent "coldness" is due to the more rapid cooling effect produced by the wind to make it feel colder than it really is. The combined effect of wind and low temperatures is experienced by most Canadians in just about every part of Canada. The effect can produce serious and often dangerous conditions.

Wind Chill Factor as described here is a measure of the combined chilling effect of wind and temperature. Although the actual calculation of the factor is based upon how fast water will cool with the combination of low temperature and wind, it has been found to be equally applicable to the cooling effect experienced by the human body and by an inanimate object.

The advantage of Wind Chill Factor over other measurement methods is that it represents a real rate of cooling, in other words how fast an object cools. For example, the combination of a specific temperature and wind speed can be related to how fast exposed flesh will freeze. On the average the value of 1625 watts per square meter presents the condition where exposed flesh will freeze. It also gives an indication of how difficult it is to maintain an object, for example a house, at a given temperature.

In the past it has been common practice to use an equivalent temperature (wind chill temperature) to relate wind and temperature. Unfortunately the values obtained by this method often have been beyond the experience of most people. For example, -50°C occurs in relatively unpopulated areas of Canada. More importantly the equivalent temperature still does not relate to the combined effect of wind and temperature on the human body. It also is too easily confused with the actual temperature.

Examples of the Effect of Wind Chill Factor

1. Water will freeze more quickly at high wind chill factors than at low.
2. The ability of an engine block heater to keep a car engine warm decreases with increasing wind chill factor.
3. The length of time a car can be left turned off before reaching the surrounding air temperature decreases with increasing wind chill factor.
4. With increasing wind chill factor there is an increase in the fuel needed to heat buildings, particularly when the building is poorly insulated.
5. Exposed flesh freezes more rapidly with higher wind chill factors.

Wind Chill Table in Degrees Celsius

Temperature (C°)	**2**	**-1**	**-4**	**-7**	**-9**	**-12**	**-15**	**-18**	**-21**	**-23**	**-26**
Wind (m.p.h.)											
Calm	2	-1	-4	-7	-9	-12	-15	-18	-21	-23	-26
5	1	-3	-6	-9	-11	-14	-17	-21	-24	-26	-29
10	-6	-9	-13	-17	-19	-23	-26	-30	-33	-35	-39
15	-9	-12	-17	-21	-24	-28	-32	-36	-40	-43	-46
20	-11	-16	-20	-23	-27	-31	-36	-40	-43	-47	-51
25	-14	-18	-22	-26	-30	-34	-38	-43	-47	-50	-55
30	-15	-19	-24	-28	-32	-36	-41	-45	-49	-53	-57
35	-16	-20	-25	-29	-33	-37	-42	-47	-51	-55	-58
40	-17	-20	-26	-30	-34	-38	-43	-48	-52	-56	-60
45	-17	-21	-27	-31	-35	-39	-43	-48	-53	-57	-61
50	-18	-22	-27	-31	-35	-39	-44	-49	-53	-57	-62

Exposed Flesh Freezes

Wind speeds greater than 40 mph have little additional chilling effect.

Table shows equivalent low temperatures from cold plus wind.

Equivalent Temperatures - Equivalent in cooling power on exposed flesh under calm conditions.

Wind chill equivalents to various celsius temperatures and wind speeds

Examples of Wind Chill Factor

Wind Chill Factor	Comments
700	Conditions considered comfortable when dressed for skiing
1200	Conditions no longer pleasant for outdoor activities on overcast days.
1400	Conditions no longer pleasant for outdoor activities on sunny days.
1600	Freezing of exposed skin begins for most people depending on the degree of activity and the amount of sunshine.
2300	Conditions for outdoor travel such as walking become dangerous. Exposed areas of the face freeze in less than 1 minute for the average person.
2700	Exposed flesh will freeze within half a minute for the average person.

The unit of Wind Chill Factor used here are watts per square meter.

Acknowledgement

Saskatchewan Research Council has assisted in providing information contained in this pamphlet.

Refer to diagram below for graph to calculate Wind Chill Factor.

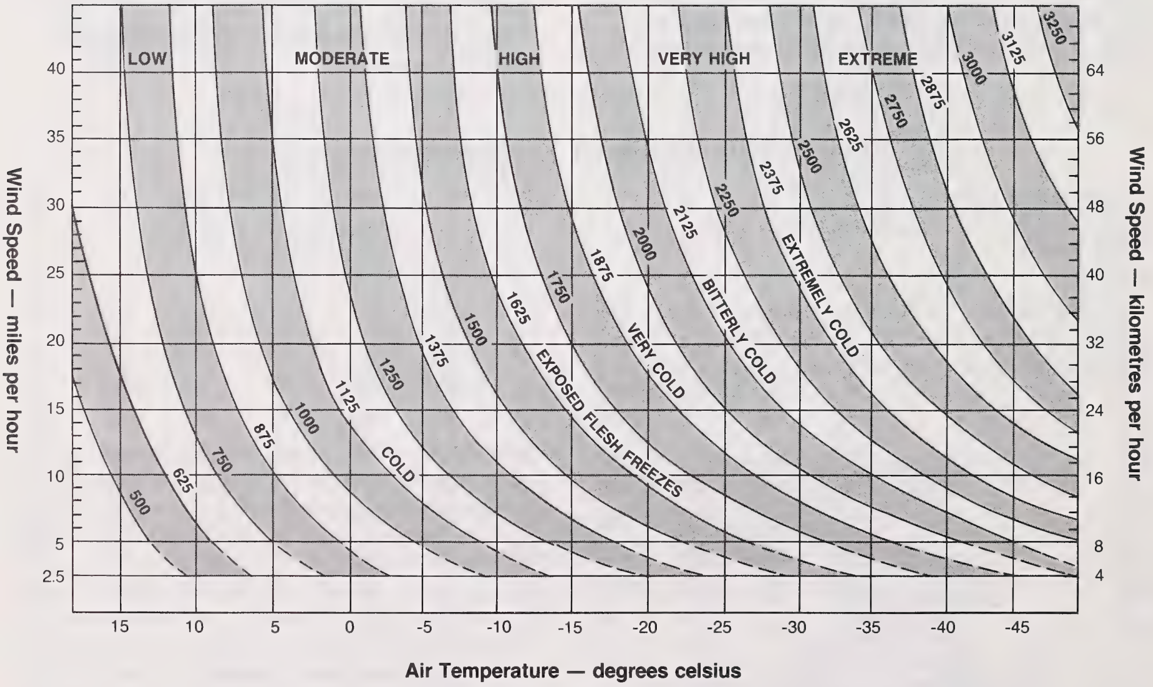
To determine the wind chill factor, follow the temperature up and the wind speed across until the two lines intersect. The value of the wind chill factor can be interpolated using the labeled wind chill factor curves.

For example, at -10°C with a wind speed of 20 miles per hour the point of Intersection lies between 1500 and 1625, or approximately 1570.

It is not recommended that wind chill factors be calculated for wind speeds below 5 miles an hour, since it is difficult to determine wind chill factors at these wind speeds and because other factors such as relative humidity become important.

Wind Chill Cooling Rates

(Watts Per Square Metre)



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